SCIENTIFIC AMERICAN

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THE PARK AVENUE IMPROVEMENT IN NEW YORK.

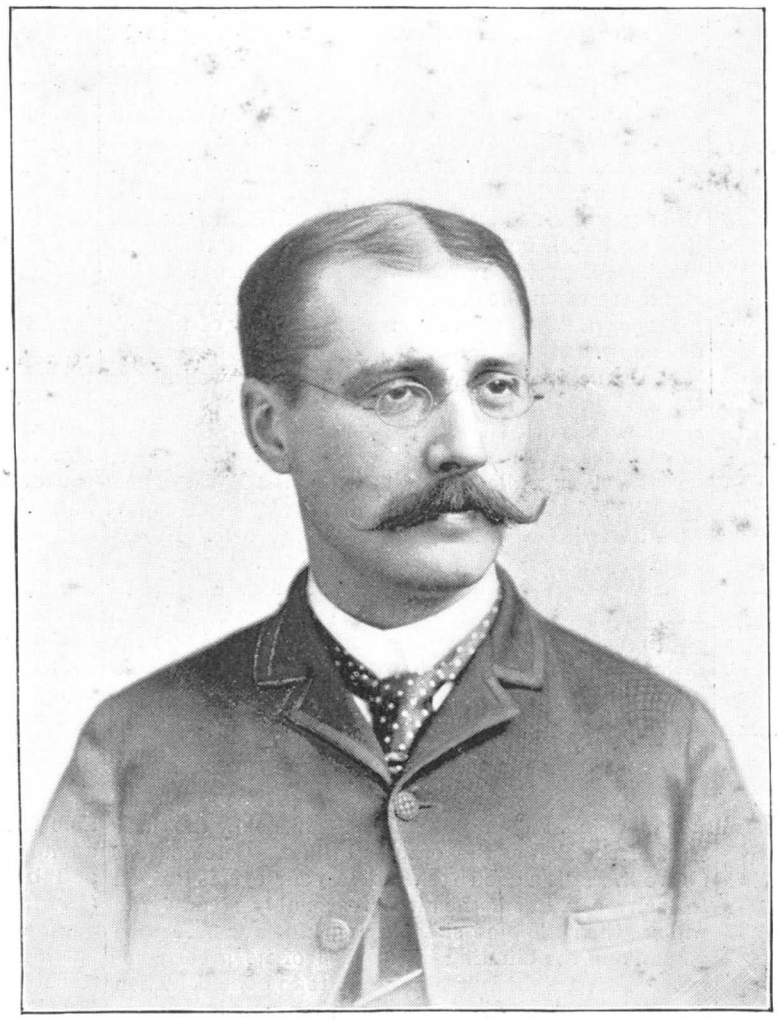
We have already given our readers a description of the Park Avenue improvement in this city, an undertaking now in full progress, and of which we present a view, the reproduction of a photograph taken on the site of operations. The improvement contemplates the removal of the four lines of railroad track used by the three great railroad companies, the New York Central, the New Haven, and the New York and Harlem Companies, whose lines end at the Grand Central Station in this city. These tracks are to be removed from the surface and placed on an elevated structure, which will span the center of the roadway. The street is 140 feet wide and the elevation of the tracks will restore to it a central area nearly 60 feet wide.

Our view, taken just below 125th Street, shows a very characteristic portion of the work. In the foreground are seen two panels or longitudinal elements of the structure almost completed. Running lengthwise of the structure are the side plate girders, 7 feet 2 inches deep and 65 feet long. These are carried on columns at the side and transverse lattice girders extend across the street, and at the center of each transverse girder a central column is eventually to be placed. But as it is impossible to put in the foundations of this column without interfering with the running of trains upon the old tracks, temporary wooden trusses are placed across the line, and these support the center of the transverse trussing, leaving all clear for the four tracks below. When the trains are transferred to the deck of the new elevated structure, the central columns will be put in place and the wooden trusses will be removed. The wooden trusses are shown very clearly in the foreground of the cut in position under the steel trusses. They constitute a peculiar form of falsework. In the distance a long series of them are seen filling up the avenue, and in the background the tower of the drawbridge now in use is seen. This will in due time be removed and supplanted by the great high level four track drawbridge which forms one of the most important links in the system.

The planking seen stretching across the span will be replaced by a box girder floor, as it may be termed, which acts as a solid trussing and flooring at once. This system, termed the solid floor system, has been extensively used on the New York Central road.

Far in the background is seen the rider spanning the work. This is a species of traveling crane used for putting the pieces in position.

For further details of the work we refer our readers to our issue of April 28, 1894.



PROFESSOR GEORGE H. WILLIAMS.

GEORGE HUNTINGTON WILLIAMS.

"Geology has lost its brightest star" was the true but sad message of condolence that flashed over the wires early last summer to comfort the sorrowing hearts of the family of one of the youngest and ablest of American geologists. The years of his life were few in number, but counted by what he accomplished, they seem like generations, for they are rich in results.

George Huntington Williams was born in Utica, N. Y., on January 28, 1856. He was the eldest son of Robert S. Williams, now president of the Oneida National Bank, and received his early education at the public schools and free academy of his native

(Continued on page 343.)

THE PARK AVENUE IMPROVEMENT IN NEW YORK.

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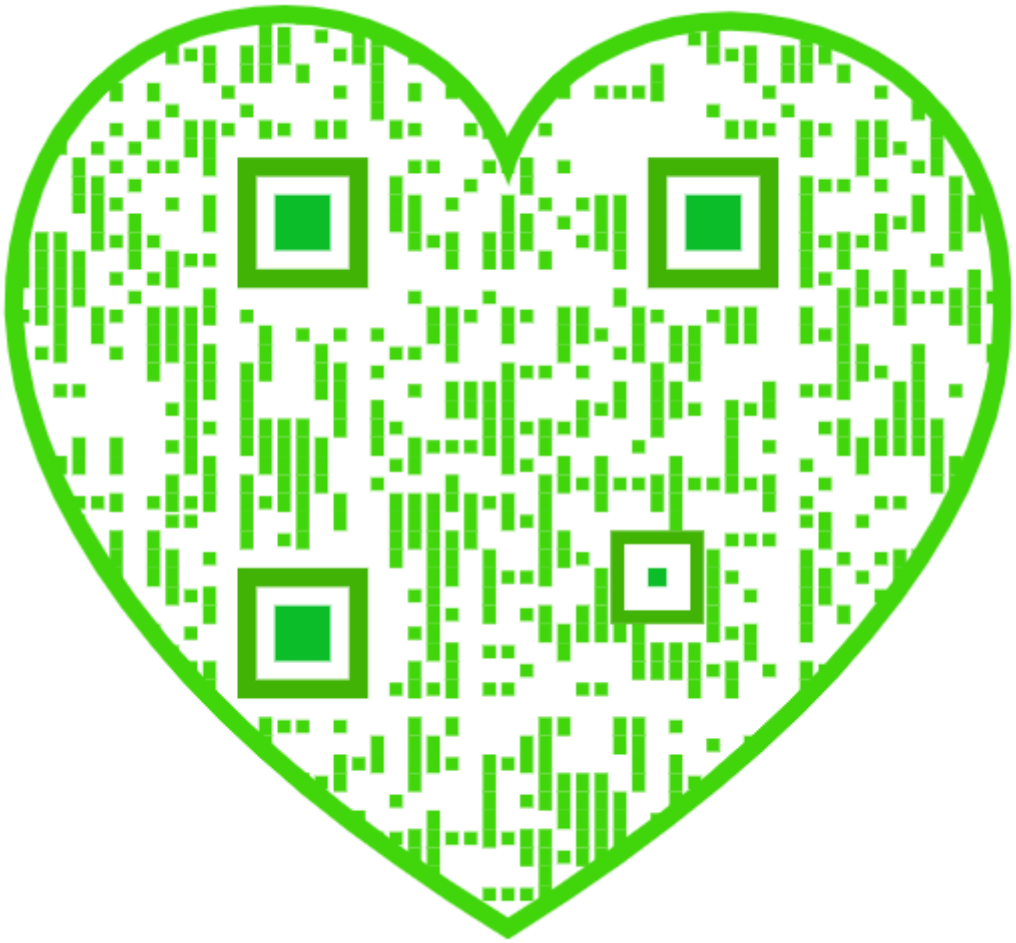

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NEW YORK, SATURDAY, DECEMBER 1, 1894.

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THE HEAVENS IN DECEMBER.

During the evenings of December the great winter constellations enter fully upon the scene, the incomparable Orion occupying the central place in the celestial spectacle like some gorgeous Eastern potentate surrounded by his vassals. It is impossible for any person of average intelligence to look upon these starry hosts, splendid as an army with banners, and not feel that there is a deep significance in the display. When all the sky is glittering with the light of distant suns, of every conceivable stellar magnitude, and many of which exhibit surprising contrasts of color, no beholder can resist the conviction thus forced upon his mind that our sun no more stands for everything that a sun may be than a rose represents all the splendor of color and all the grace and beauty of form that can exist in a garden filled with every variety of flowers. Fortunately for those who have eyes to see, these wonders of the heavens are not merely to be read about, like the departed glories of the Caliphs of Cordova, but any one who chooses may see them for himself. And there is no better time to begin an acquaintance with the stars than in the opening month of winter. But the unlucky denizens of cities never see Orion and Taurus and the starry fields of the Galaxy as their country cousins do. Aldebaran never looks so like a flaming ruby suspended in the firmament, and Sirius never blazes with such dazzling beauty as when the dark vault they adorn rests upon hilltops sparkling with the frosted jewelry of untrodden snow.

At the beginning of December Orion is well above the horizon by 8 P. M., and at the end of the month it is half way to the meridian by that hour. The best time to see it is after 9 P. M., when Sirius, the Dog Star, has also risen, while Taurus, carrying the Pleiades and Hyades, shines above it toward the west. and Gemini, with its twin stars, follows high in the east. Northward from Orion, and near the zenith, at the same hour will be seen the brilliant white star Capella in Auriga. The Milky Way then spans the sky like a glowing arch, beginning at the eastern horizon near Sirius, passing across Auriga, Perseus, and Cassiopeia in midheaven, and disappearing in the northwest, where the Northern Cross lies athwart its course and the beautiful Vega glitters on the verge of the horizon.

Now take out your three-inch telescope and try if you can see the companion of Rigel, the bright, white star in Orion, which you find as far below the three stars of the Belt as the orange brilliant Betelgeuse is above it. It is a good test, unless your eye is trained to such work, but if the air is reasonably steady, you will see the little blue star playing hide and seek with you among the blinding white rays of its great comrade. It is a sight worth a frost bite to behold. Then turn to the Great Nebula, and when you have wondered sufficiently at that, drop your glass a little until you have caught the multiple star, Iota, in the field. (See Proctor's Atlas.) It will certainly surprise you, if you have not seen it before, and if you have, you will be delighted to see it again. Your glass may not show more than one of the two nearest companions of the largest star in the field, but you will find gems enough within sight. Orion and its neighboring constellations abound with beautiful telescopic objects, which I have not space even to mention here.

But no matter if you have no telescope; take your opera glass, and with it survey the Pleiades (splendid sight!) and the Hyades. which some people call the letter A or the letter V, and whose chief brilliant is Aldebaran. Look also with your opera glass at Orion's Belt, and sweep with it along the Milky Way, particularly that part of it which is nearly overhead. You cannot guess what a revelation lies within the power of so humble an instrument.

From the stars we turn to the planets. Mars is still in view, crossing the meridian about 8:30 P. M. at the beginning of the month and about 7:30 P. M. at the end of it. It is still possible with telescopes of moderate power to see some of the markings on the planet. During November several of the "canals" were seen to have become double.

Jupiter will gradually become a more glorious object as the month grows older. He is in opposition on the 22d. At the beginning of the month he rises at 6 o'clock in the evening and crosses the meridian about 1:30 A. M.; at the end he rises at sunset and crosses the meridian at midnight. A 3 inch telescope will reveal a wealth of details on his belted disk. Watch also for the eclipses and transits of his satellites. The shadow of a satellite during transit is like a minute drop of black ink on the lightly-colored face of the planet. I give two or three of the convenient dates on which these phenomena may be seen. On December 2, satellite I will be eclipsed in Jupiter's shadow at 10:50 P. M., and will reappear from behind Jupiter at 1:34 A. M. December 3. The same satellite will cross the face of Jupiter on the night of December 3, its shadow appearing a little in advance. The transit of the shadow will begin at 8:08 P. M. and that of the satellite at 8:37 P. M. The shadow will pass off at 10:24 P. M., and the satellite at 10:53 P. M. On the **10th, satellite I will again transit Jupiter,** the shadow appearing at 10:02 P. M., and moving off at 12:19 A. M., December 11. As before, the satellite will follow just behind the shadow. On the 15th satellite II will transit the planet, the times of the beginning and end of the crossing for the shadow being 9:05 P. M. and 11:42 P. M. respectively, and for the satellite 9:27 P. M. and 12:03 A. M., December 16. This is all in Eastern standard time; deduct one hour for central time.

The month opens with a crescent moon. The moon reaches first quarter on the 5th at 7:15 A. M., fulls on the 12th at 2:45 P. M., and attains last quarter on the 19th at 6:15 A.M. The new moon of the month occurs on the 26th at 9:20 P. M. The moon will be in apogee early in the afternoon of the 2d, and about 6 o'clock in the morning on the 30th, and in perigee a little before 9 o'clock on the morning of the 14th. The moon will be close to Mars on the evening of the 8th, and to Jupiter on the morning of the 13th.

The sun enters Capricorn, and the astronomical winter begins on the 21st at 9 minutes after 3 o'clock in the afternoon.

GARRETT P. SERVISS.

What a Colliery Manager Should Know.

A writer in the Science and Art of Mining, whose opinion was asked as to the subjects in addition to the three R's (reading, writing and arithmetic) that a person aspiring to hold a colliery manager's certificate should endeavor to get a thorough knowledge of, replies as follows:

The subjects, in addition to the three R's, which intending colliery managers should endeavor to get a thorough knowledge of are as follows: (1) Geology, which gives them a knowledge of the rocks forming the earth, and the formations in which coal is found; also of faults, dikes, wash-outs, etc., which interrupt the continuation of coal seams. (2) Boring and sinking, a knowledge of which is required in opening new royalties and in searching for coal seams that have been dislocated by faults, etc. (3) The practical working of mines, which enables them to lay out a mine on the most advantageous systems of working, hauling and drainage. (4) Principles of mechanics, which enables them to know the strength of beams, girders, ropes and chains required for different kinds of work; also the horse power of engines required for winding, hauling and pumping certain quantities of water. (5) Steam, compressed air and electricity. The properties of steam and the principles of the steam engine enable them to use steam economically and to the best advantage, and to superintend the erection of engines, and be a help to them in purchasing new engines. Compressed air, which enables them to know the advantage of it over steam for driving, drilling and coal-cutting machines. Electricity, so that they may know something of the advantages of electric signaling and lighting, and of the transmission of power for long distances. (6) Mine ventilation, gases, coal dust, lighting of mines, explosives and blasting. A thorough knowledge of these, if properly carried out, insures the safe working of a mine, and will considerably reduce the causes of explosions. (7) Surveying, because the manager is responsible for the plans to be produced to the inspector and for his workings trespassing into other royalties, and for leaving sufficient coal under surface erections, etc. (8) The Coal Mines Regulation Act, which should be well understood to comply with the act in all details for safety. (9) And last, but not least, he must study mankind, so as to be able to deal properly with and manage men of all shades of opinion.

Invent Something.

"One of the best opportunities for a young man to make money quickly in these days," said a self-made millionaire to a writer in the New York Tribune, "is to rack his brains until he has invented something useful or that the public wants. A general impression prevails that it takes a skilled engineer or a man of phenomenal inventive ability to develop anything useful to manufacturers in this age of machinery. But there is a wide field open to shrewd amateurs, so to speak, to supply little articles of convenience to housekeepers, shopkeepers, etc., and designers can be had at reasonable rates to execute the idea, once it is conceived. American women are so accustomed to getting what they want that anything which lightens their labors in the household is sure to go. When I was a boy on the farm at home, my mother used to make me clean all the dinner knives on Sunday with a bath brick. Now, scraping this brick into a fine powder, without lumps in it, used to be the most tedious part of the whole work. The other day I heard of a man who has made a fortune by supplying the trade with powdered bath brick in neat packages. You know how difficult it is to pick up small coins from a wooden counter. Yet the whole civilized world has growled at and endured it since coins were stamped and counters made, until the other day a young fellow invented a rubber mat with little bristles of rubber standing up thickly all over it. Coins thrown on the mat are as easily picked up as if they stood on edge. The public was quick to appreciate it, and the inventor need not work for a living any longer."

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The Antiquity of Iron and Steel.

BY G. D. HISCOX, M.E.

The use of iron and steel in the early ages of the human race has been a much mooted subject in past years.

The means of quarrying and dressing the hard granitic stones of the pyramids, obelisks, giant statues, vast temples of Egypt and the rock-cut temples of India have been matter of mystery only because the proper tools for this work have disappeared from the remains of ancient appliances.

To satisfy modern ideas as to the nature of this mystery an ideal resort to some substitute for iron and steel has been made in a mythical bronze, the manufacture of which has been assumed as a lost art.

An alloy of the only metals known to the ancients that produce a hardness suitable for cutting tools is as well known to-day as in the early ages; but no such alloys are suitable for cutting granite or sienite, although marble, slate, and sandstone readily yield to their cutting pressure.

The finding almost exclusively of metallic tools and instruments, relics of a reputed bronze age, does not conflict with the probability of a contemporaneous use of iron and steel, for the resisting properties of bronze to oxidation by exposure to the damp atmosphere where such relics are usually found is vastly greater than with iron and steel; yet the few samples named as iron (possibly steel) that have been found in protected situations are facts of value.

The British Museum contains the Layard collection found at Nineveh of Assyrian armor plates, shields, battle axes, saws, and other objects of iron or steel of a date probably 1,000 or more years before the Christian era; and as history goes, the prints of various articles of oxidized iron were there uncovered, to fall to pieces by handling, that would have remained intact if undisturbed for countless ages.

If those cutting instruments had been made of steel, no trace of the fact would be left in their oxidized remains, for the steel constituting element would naturally disappear in the oxidizing process.

The Chalybians, a Scythian race, were makers of steel 500 years B. C., and their name was given to the finest steel by the Greeks.

India has been celebrated from the earliest times for the quality of its steel; its Wootz is referred to as of the highest grade, and to it, or the Chalybian steel, may have been due the renown of the Damascus blades.

The iron column at Delhi, a forging not to be sneered at from the standpoint of our largest modern forged shafts, was bloomed, welded, and chipped into a symmetrical form with a complex fluted capital, that nothing but steel chisels and hammers equal to our modern tools could have been used to mould into such artistic form. It is a marvel of antiquity; 60 feet in height, about 16 inches diameter at base, tapering to 12 inches at the top, with an enlarged capital with ornamental fluting. Its estimated weight is 17 tons. It dates from an age about 900 years before the Christian era, thus showing an advanced state of the art of iron working almost prehistoric; for a work of that magnitude could not possibly be produced at that age of human civilization and art without ages of previous apprenticeship. It stands alone above all other relics, a monument commemorative of the state of the mechanic arts in prehistoric times, only paralleled by the discovery of iron and steel tools in the tumuli in India of a supposed date some 1,500 years before the Christian era.

China also claims a great antiquity in the process of making iron and steel; the Chinese record minutely describing the processes is still preserved and is accredited as from a very early age by archæologists.

The mariner's compass dates back to 1100 B. C. in Chinese history. We cannot conceive of anything but hardened steel suitable for the compass needle.

Coming back to the supposed centers of ancient civilization, Tubal Cain was an "instructor of every artificer in brass and iron," which was also well known in the times of Moses, 1,500 years B. C.

The iron wedge found in the Great Pyramid and the sword blade found by Belzoni under the Sphinx at Karnak carries the date back 3,500 years B. C., and possibly to 4,400 years, to the times of Menes.

Job mentions a pen used to engrave upon rocks and a bow of steel, while Homer alludes to the tempering of steel by the plunging of the hissing ax into cold water.

The reputed iron wedge found under the obelisk now in Central Park was probably a semi-steel, as it was found to contain by analysis over a half per cent of carbon and smaller portions of other constituents as usually found in blister steel; which indicates a probability of a practice in those early times of conversion of iron into steel by cementation.

The inhabitants of Great Britain were manufacturers of iron before the landing of the Romans, who fostered the art there and worked bloomeries and Catalan forges before and during the first century.

It has been suggested that corundum set in bronze chisels was the material that worked the chiseled surfaces of the huge blocks of sienite and basalt of the Egyptian temples and their intagliated inscriptions; but when we consider its brittle nature, and how small a blow will split and crush the crystals, the suggestion becomes but an idle thought.

There is no doubt that iron and copper saws and tubular drills were in use with pulverized corundum or emery as an abrading material for sawing and drilling the hardest granite. On this the evidence is very conclusive from the observed saw and drill marks and the simplicity of the operation.

The use of laps for grinding and polishing tablets, cylinders, signets and precious stones, and the methods of engraving their inscriptions by revolving tools charged with corundum or emery, is too well attested by a close inspection of the numerous and beautiful examples in our Metropolitan Museum and in possession of collectors of these most antique relics of an almost prehistoric civilization.

Emery and corundum were well known to the ancients, being found in large quantity in the islands of the Grecian Archipelago, in the vicinity of Smyrna and ancient Ephesus in Asia Minor. The repute of the lapidists of Magnesia, Ephesus, Tralles and Tyre were of note early in the pre-Christian age.

The commerce of Egypt extended over all these regions and far to the east, and it is reasonable without a doubt that not only the art of cutting, sawing and drilling with emery was accessible to the Egyptians in the earliest times, but that the use of hardened steel tools should not also have spread to Egypt as a commercial commodity, if the ore and its manufacture into iron did not exist there.

It is well authenticated that among all the bronzes yet found, there is not a single instance mentioned of a hard bronze cutting tool. Nearly all are of the ordinary alloys of copper and tin, and but few that even approach to a proper hardness for cutting any hard substance.

Thus through the long ages that the mechanic arts are known to have flourished, with an occasional cloud obscuring or retrograding their progress, they seem to have had their periods of brightness coincident with the shining eras of early civilization at various points and at various times; and which may be noted in the culmination periods of successive and dominant nationalities.

China, India, Persia, Babylon, Nineveh, Assyria, Egypt, Palestine, Tyre, Greece, Byzantium, Carthage, and at last the Roman empire completed the cycle of the arts of ancient time, and marked the beginning of the second age of the world's civilization with its grand evolution of the modern era of the arts and sciences.

Phosphorescence at Low Temperatures.

Investigations have been undertaken by Raoul Pictet, the intention being to determine the specific action of a considerable lowering of temperature upon the brilliancy of certain bodies which shine in the dark after having been exposed to sunlight. Tubes of glass filled with the powdered sulphides of calcium, barium, strontium, etc., all substances which possess the property of phosphorescence in a high degree, were exposed to the solar rays and afterward proved to be luminous in the dark. This was done in such a way as to fix upon the memory the mean value of the progressive diminution of the emitted light, and the time also was noted during which the light was strong, less strong, and weak respectively. The tubes were next placed in bright sunlight for one minute and then suddenly introduced into a double walled glass cylinder, the interspace of which was filled with nitrous oxide at —140° C. In about five or six minutes the temperature of the tubes was about —100°. They were then withdrawn and, when observed in a perfectly dark chamber, no luminosity whatever was perceptible. As the tubes recovered their normal temperature, however, the phosphorescence returned, without the exciting agency of either the sun's rays or diffused light. These results were proved to be general for all phosphorescent substances employed. The complete suppression of phosphorescence at very low temperatures having been thus demonstrated, attempts were next made to fix the limits of temperature at which the luminosity ceases to be visible. Tubes of phophorescent powder were exposed to sunlight, then rapidly conveyed to the dark chamber and partially immersed in alcohol cooled to —75°. The phosphorescence disappeared completely from the portion of the powder contained in the part of the tube immersed, when its temperature was reduced to —60° or —70°, but after immersion for more than half an hour the light returned spontaneously as the effects of cooling wore off. The phenomena were alike with all the phosphorescent substances examined. The blue, green, or orange light emitted by different metallic sulphides tended in all cases to change to an earthy yellow before being extinguished. It was proved by repeated experiments that condensed moisture on the outside of the tubes did not in any way influence the extinction of the phosphorescent light, or affect any of the observed results. It appears certain, to Pictet, that the production of phosphorescent light requires a certain movement of the constituent molecules of bodies. When these are frozen and the calorific oscillatory movements are checked, the luminous waves are not produced and the phosphorescence disappears accordingly.—Compt. Rend.

The First American Patent.

The first patent granted in the New World, so far as we have information, was that issued by the General Court of Massachusetts, to Joseph Jenkes, March 6, 1646, for an engine for mills, to go by water. In other words, it was a water engine. The patent was granted for fourteen years. The following is a copy of the patent:

JENKES MONOPOLYE.

At a generall Courte at Boston
the 6th of the 8th mo 1646

The Cort considringe ye necessity of raising such manifactures of engins of mils to go by water for speedy dispatch of much work wth few hands, & being sufficiently informed of ye ability of ye petitionr to pforme such workes grant his petition (yt no othr pson shall set up, or use any such new invention, or trade for fourteen yeares wthout ye licence of him ye said Joseph Jenkes) so farr as concernes any such new invention, & so as it shalbe alwayes in ye powr of this Corte to restrain ye exportation of such manifactures, & ye prizes of them to moderation if occasion so require.

Joseph Jenkes, of Hounslow, County Middlesex, England, settled at Lynn, Mass., in 1643, where he died in 1683, aged 81 years.

"A man of great genius." He made the dies for coining the first money; also built the first fire engine in America.

His son Joseph was governor's assistant of Rhode Island in 1681, and built a large iron foundry near Providence.

His grandson Joseph was governor of Rhode Island, 1727–1732.

The Portrait of a Public Man is Public Property.

In the United States Circuit Court, Boston, Judge Coit presiding, a suit was brought by the widow and children of George H. Corliss, the inventor and builder of the Corliss engine, to enjoin the defendants from publishing and selling a biographical sketch of Mr. Corliss and from printing and selling his picture in connection therewith. The bill did not allege that the publication contained anything scandalous, libelous, or false, or that it affected any right of property, but the relief prayed for was put on the novel ground that the publication is an injury to the feelings of the plaintiffs and against their express prohibition.

In August, 1893, Judge Coit decided that the plaintiffs had no right to an injunction preventing the publication of the biographical sketch, and the present decision is on the photograph alone. The court now says, in part:

While the right of a private individual to prohibit the reproduction of his picture or photograph should be recognized and enforced, this right may be surrendered or dedicated to the public by the act of the individual, just the same as a private manuscript, book or painting becomes (when not protected by copyright) public property by the act of publication. The distinction in the case of a picture or photograph lies, it seems to me, between public and private characters. A private individual should be protected against the publication of any portraiture of himself, but where an individual becomes a public character the case is different. A statesman, author, artist, or inventor who asks for and desires public recognition may be said to have surrendered this right to the public. When any one obtains a picture or photograph of such a person, and there is no breach of contract or violation of confidence in the method by which it was obtained, he has a right to reproduce it, whether in a newspaper, magazine, or book. It would be extending this right of protection too far to say that the general public can be prohibited from knowing the personal appearance of great public characters. Such characters may be said of their own volition to have dedicated to the public the right of any fair portraiture of themselves. In this sense I cannot but regard Mr. Corliss as a public man.

Submarine Torpedo.

Mr. Seymour Allan, a resident of Sydney, has invented a submarine torpedo boat, which, he claims, is capable of sinking to any depth, and of traveling rapidly under water without revealing its presence. A working model of the boat was tried on October 30 in the public baths at Sydney, in the presence of the Earl of Hopetoun, the governor, the naval commandant, and a number of naval and military officers. The experiments were a complete success, the model rising, sinking, turning, reversing, or remaining stationary in obedience to the electric current by which it is worked. The inventor claims that a full-sized boat would be capable of remaining under water for three days. It would carry torpedoes on the bow and stern decks.

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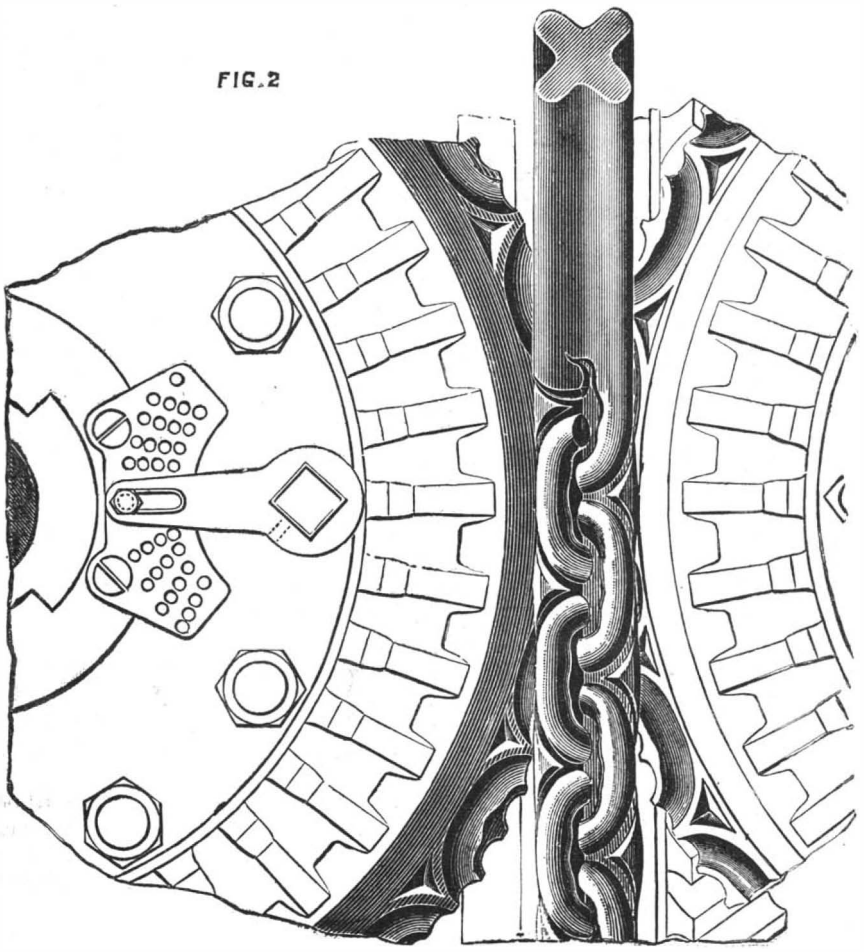
[FROM THE ENGINEER, LONDON.]

ROLLED WELDLESS CHAINS—KLATTE'S PROCESS.

Mr. O. Klatte, the manager of the Walzwerk Germania, at Neuweid-on-the-Rhine, has recently successfully worked out a system of manufacturing weldless chains, in which all the tedious operations of repeated heating, forging, and punching are avoided. This is effected by simply rolling the chains. As in Oury's and Rougier's processes, the original form is a cross bar. This is passed between four rolls, of which the working circumferences are beveled, so that the lines of contact, when brought close together, are at right



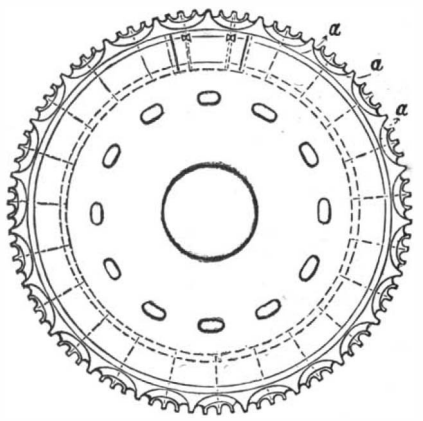


FIG. 3.

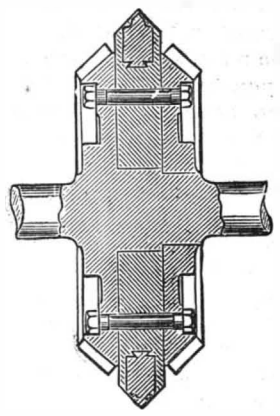


FIG. 4.

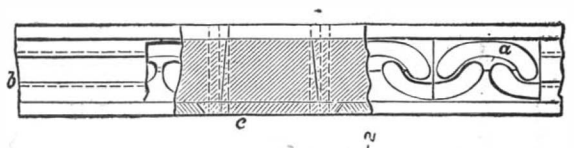


FIG. 5.

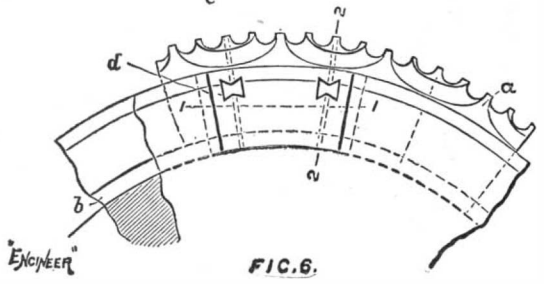


FIG. 6.

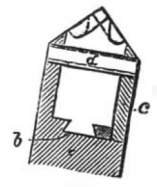
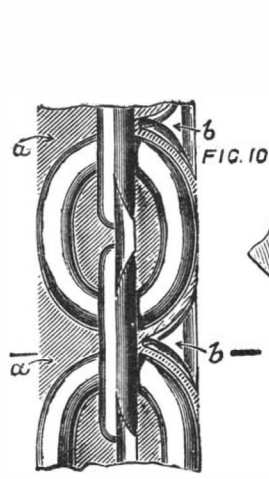
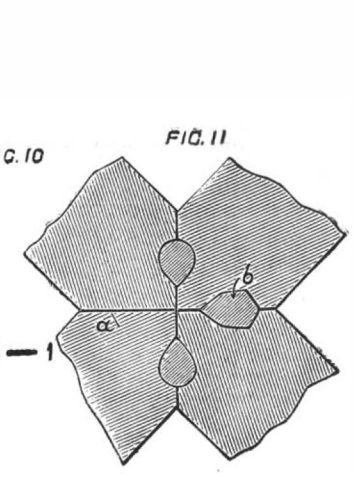


FIG. 7.





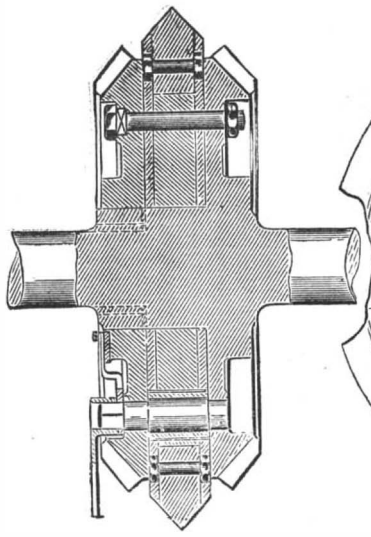


FIG. 8

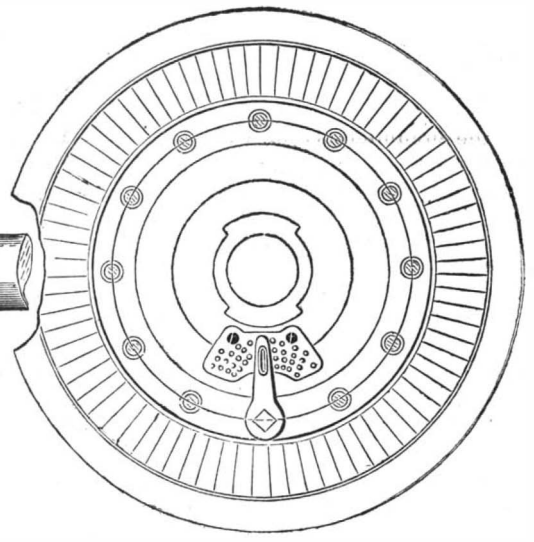
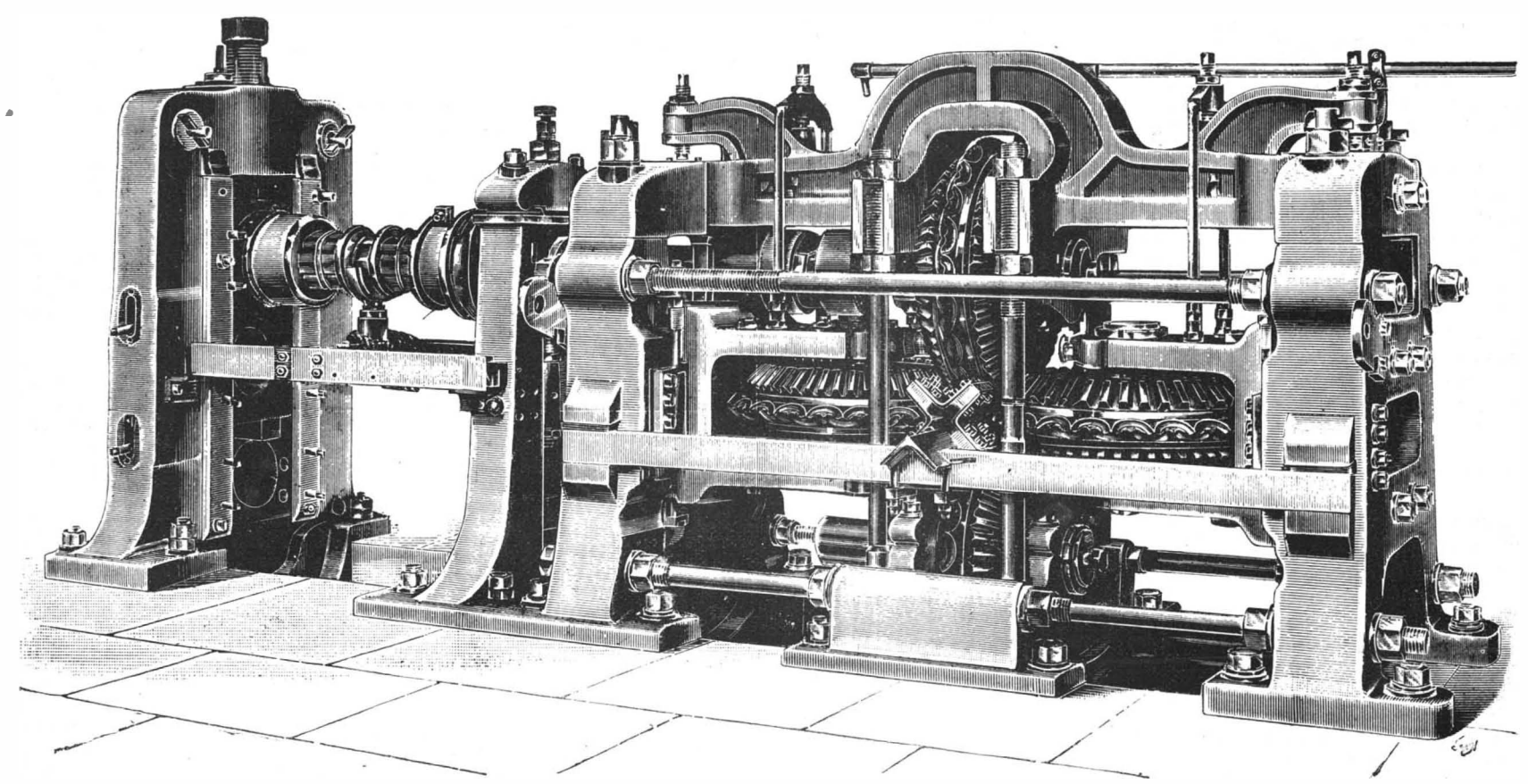


FIG. 9

IMPROVED MACHINERY FOR ROLLING CHAINS, WITHOUT WELDING.



MACHINE FOR ROLLING CHAINS FROM THE BAR.

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angles to each other. By means of these rolls the material is squeezed, where not required, inside and between the future links, into a thin web, and what, for convenience, may be called the chain bar, is formed, having the shape illustrated at b, Fig. 1, in which a shows the original cross bar.

The arrangement of the rolls will be best understood by reference to Fig. 2, in which a bar is shown during its passage through the rolls with the top roll removed. The conversion of the cross bar into the chain bar is carried out in one heat. After leaving the rolls, the chain bar is passed through a punching machine, with automatic feed, by means of which the webs are removed. This is done while the material is still slightly warm. As rolled, the width of the chain links is somewhat greater, and the length consequently somewhat less, than is required in their finished state. In order, therefore, to give them their final shape, the chain bar, of which the links are still connected by a slight web where inaccessible to the punches, is reheated to a red heat and passed under a press, by which the links are reduced to the specified width. The same end can also be attained by the use of finishing rolls, which stretch the links to the necessary extent. In either case the links are finally separated during the operation. The velocity with which the chain bars are rolled depends, of course, upon the dimensions, and ranges from 10 feet to 20 feet per second.

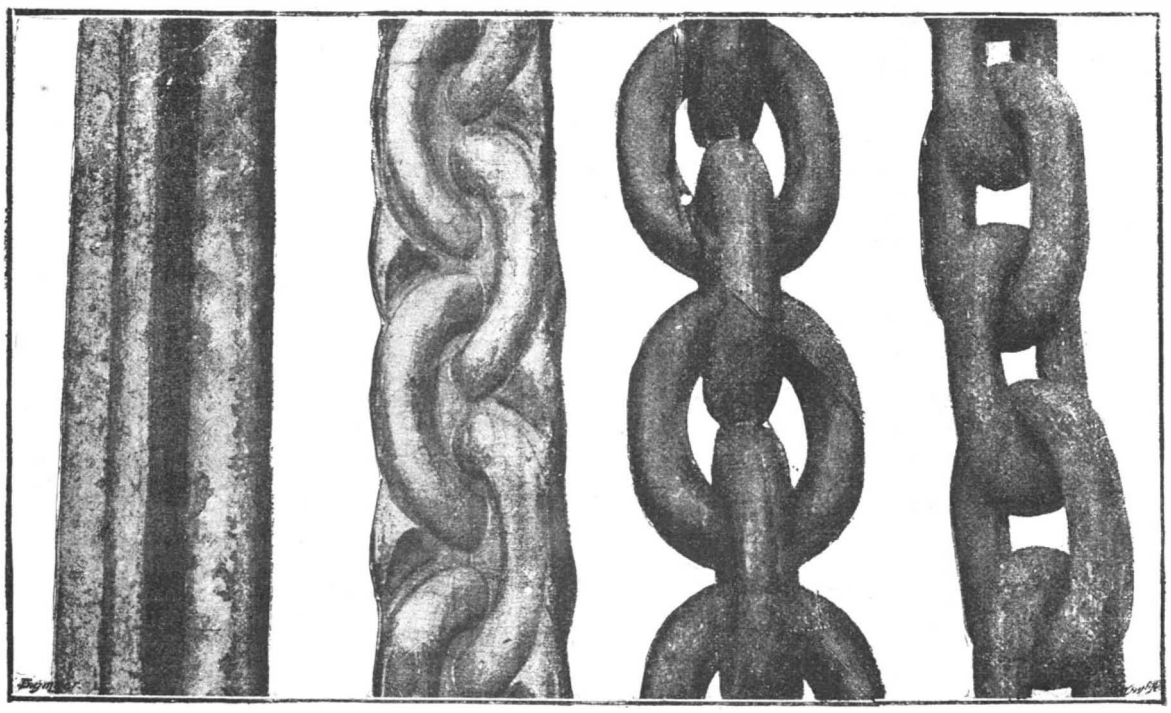
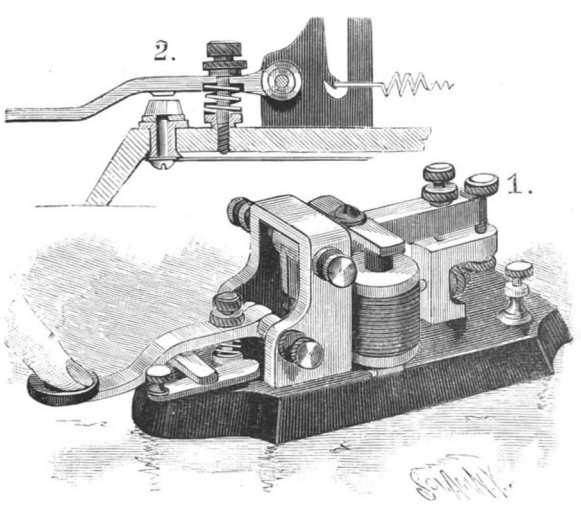


Fig. 1.—DEVELOPMENT OF THE CHAIN FROM THE BAR.

Having given the general outlines of Mr. Klatte's process, we now come to the details, upon which, as in every similar case, the success of the invention depends. The detailed construction of one of the rolls is shown in Figs. 3 to 7. It consists of a central disk—secured, as shown in Figs. 3 and 4, between two bevel wheels—to the circumference of which are dovetailed and keyed a number of sectors constituting the working portion of the roll in which the dies or matrices are formed.

By removing the key piece, c, an opening is uncovered, through which one sector after another can be inserted and pushed into its proper position on the circumference. When all the sectors are in place, the piece, c, is again inserted, and the two keys, d, driven in; the latter secure the sectors against displacement. The sectors are in the first place rolled as bars, with the necessary cavities—or matrices—impressed in them. These bars are afterward cut to the required lengths and fitted, while the finishing of the matrices is effected by cutters, on a machine specially designed for the purpose, of a type similar to those employed in the manufacture of small arms. It has been found that steel with a tensile strength of from 32 to 38 tons per square inch is a suitable material for the sectors. Instead of sectors, a complete ring may be used, but for facilitating the renewal of worn or damaged parts sectors are very convenient. Experience has proved that the rolls do not appreciably suffer by use, as with all the trials which have been carried out with one set of rolls no measurable wear has been observed. This is due to the large diameter of the rolls—from 3 feet 3 inches to nearly 5 feet—and also to their high velocity.



COX'S TELEGRAPH KEY AND SOUNDER.

If any supplementary shaping of the matrices is necessary, the rolls are supported on pedestals and the circumference heated to a red heat and annealed. Hitherto, no distortion has been found to result from this treatment. Damaged or defective sectors can easily be replaced. Instead of being fitted together in the manner already described, the sectors may be dovetailed together; there is no difficulty about this. In order to facilitate the adjustment of the four rolls relatively to each other, the device illustrated in Figs. 8 and 9 is adopted. This consists of an eccentric fitting the central disk of each roll, and having its bearings in the wheel plates or webs between which the roll is secured. The eccentric is turned by a spanner, and when adjusted is kept in place by means of a lever and set screw, as clearly shown in the illustration, Figs. 2, 8, and 9. In the construction of the matrices many points have to be considered, not only with regard to the durability and strength of the projecting portions—or teeth, as they may be termed—but also as to the important part which is played by these teeth in displacing the material of the crossbar. The form of the teeth also depends on the shape of the links, whether long or short. As the corresponding matrices for each link on the four rolls come together, the process of rolling is in reality interrupted, and room must therefore be provided for the lateral displacement of the material. This is effected by means of a suitable distribution of space in the cavities of the rolls, and the inventor has, for instance, in the case of one set of rolls, provided for the "spreading" of the material during the process of rolling by giving the links a larger section at the points of contact, where they are subject to the greatest strain and wear.

As regards the general method adopted, the bloom is rolled in the usual manner into a bar of suitable section for the production of cross steel, having a length of about 50 feet. This bar is reheated in a furnace of corresponding length, and then passed automatically through a series of quadruple rolls, arranged in line one behind the other, and calibrated. On leaving these rolls, the length of the bar will have increased to between 98 feet and 130 feet, and it is transferred directly in the same heat to the chain rolls, in which it is finally stretched to from 164 feet to 197 feet. When longer chains are required, special wire chain links are provided for connecting several rolled lengths.

The cost of production by Mr. Klatte's process compares favorably with that of the old method of chain making, and advantages over the latter in other respects are claimed. The results of official tests, carried out at the Royal Experimental Institute at Berlin, with "Klatte" chains of different kinds of steel, and also with an ordinary welded chain, show the great superiority in strength of these machine-made chains over the wrought iron welded chain.

A TELEGRAPH KEY AND SOUNDER.

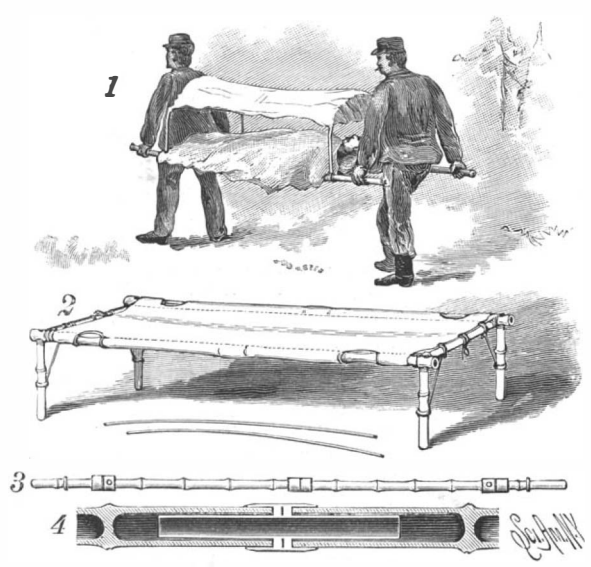
The combination device shown in the illustration has been patented by Mr. Philip D. Cox, of Hawthorn, Florida, and presents some novelties in construction and arrangement of parts. The yoke of the sounder magnet is centrally let into the base, which is preferably made hollow to admit of making the electrical connections of the instrument underneath. The standard is in the form of an arch in the lower part of which are journaled the trunnions of the key, and between its trunnions and the anvil contact, as shown in the sectional view, Fig. 2, the key is apertured to receive a stud screwed into the base. On the threaded lower end of the stud, above the base, is a nut on which rests a spiral spring, whose upper end is received in a cavity in the under side of the key, while on the stud are nuts to adjust the lift of the key, a top jam nut preventing accidental loosening. At the side of the anvil contact is pivoted the circuit-closing lever, and the key and sounder is placed in the circuit by inserting wires in the binding posts at the rear, being operated in the usual way.

The Vanishing Mountains.

In a paper which he recently read before the Scientific Congress at Paris, M. De Lapparent expressed the opinion that all mountains will vanish off the face of the earth in course of time. He declared that, if the actual natural forces at work upon our globe retain their present intensity, in 4,500,000 years all inequalities of surface will be leveled. He instanced as a striking example the reduction of the Ardennes, which were once a chain of the Alps, but which had already shrunk to their present dimensions at the outset of the Tertiary epoch. The Alps, he said, exemplified the youth, the Pyrenees the maturity, and the mountains of Provence the declining years of mountain ranges, while the central plateau of France was typical of their death and dissolution.

AN IMPROVED LITTER.

By means of the simple litter shown in the illustration a patient may be conveniently carried to and transported in an ambulance or train, then successively moved to the hospital, to the operating table, and placed in bed, without being once bodily lifted, thus avoiding unnecessary pain and hemorrhages, or the complication of fractures. The improvement has been patented by Dr. R. Ortega, of Ciudad Porfirio Diaz, Coahuila, Mexico. Fig. 1 represents a litter of this kind as in actual use, Fig. 2 showing it set up as a temporary cot, Fig. 3 representing one of its side bars, and Fig. 4 the side bar joint. On the ends of the side bars are removable handles, connected by hooks with transverse cross bars, and the fabric used is preferably canvas covered by oilcloth. The fabric is made in two pieces, separated longitudinally at the middle of the litter, the two sections being united by a string passed through alternately arranged loops, along the line of separation. When the string is withdrawn from either end, the two sections can be readily moved from under the patient, one to the right and the other to the left. The outer sides of the fabric sections have welts or sheaths through which loosely pass the side bars, portions of the welts being cut out to form hand holes for the carriers. The side bar joints, as shown in Fig. 4, are formed of threaded ferrules, through which extends a short piece of pipe embedded in a suitable substance, the side bars being



ORTEGA'S LITTER OR STRETCHER.

preferably of bamboo or similar light and suitable material. Each of the handles has a threaded head screwing on the end of a tube in the end of each side bar section, each head also having a transverse threaded aperture by means of which each handle may be arranged as one of the legs when the litter is set up as a cot. The side bar sections and handles may thus be readily taken apart and the entire litter packed in a very small bundle. A light awning for this litter is readily made of bamboo rods covered by a light fabric, the cover being arched by inserting the ends of the rods in apertures in the side bars.

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Correspondence.

The Awning over the Colosseum in Ancient Rome.

To the Editor of the SCIENTIFIC AMERICAN:

In a late issue of the SCIENTIFIC AMERICAN your correspondent, writing from Rome, alludes to the awning or canopy which is said to have been stretched over the interior of the Colosseum by the ancient Romans. The existence of such a canopy is a matter of general belief, and indeed is asserted by many modern authorities. The "Encyclopedia Britannica" (Tit. Amphitheater) and the "American Encyclopedia" (Tit. Colosseum) and "Chambers's Encyclopedia" (Tit. Amphitheater) refer to it without question. In your paper of December 27, 1890, you print an extract from the St. James's Gazette, under the heading "Ancient Engineering Feats," as follows:

"Is Mr. Eiffel prepared to put an awning over Trafalgar Square when the sun shines and remove it promptly, without the aid of a central support or steam engines, or even chains? The area of the Colosseum is certainly not less. This may seem a trifling matter to the thoughtless, because they have never considered it. Roman engineers covered that vast expanse with some woolen material, and they worked the ponderous sheet so easily and smoothly that it was drawn and withdrawn as the sky changed. The bulk of it must have weighed hundreds of tons, all depending by ropes from the circumference. But the ancients thought so little of this feat that they have left us only one trivial detail of the method."

The writer of the above does not mention the author by whom this "trivial detail of the method" is referred to, and I have been unable to discover the passage. The only allusions to the awnings (velaria or vela) in the amphitheater which I have been able to find with the aid of a distinguished scholar in Roman literature are the following: Two or three lines in Juvenal (iv., 122) speak of an admiring spectator of the games as follows: "He applauds the cuts and thrusts of the gladiator, and the stage machinery by which boys are raised up to the awnings" (velaria).

Pliny (Nat. Hist., xix., 23) tells how certain fabrics came to be first used in Rome for "awnings (vela) over theaters." He also says they were placed at one time over the Sacra Via and the Forum of Augustus, but he gives no description of their arrangement and makes no special reference to the Colosseum. And finally, Lampridius ("Life of Commodus," xiii., 17) makes the following statement about that genial emperor: "At one time when he was fighting in the theater the populace applauded him as a god, but he, supposing they were mocking him, ordered them to be set upon and slain by the sailors who managed the awnings (vela) in the amphitheater."

It is from such meager allusions apparently that the theory has been devised that an immense canopy, five and a half acres in area, was stretched across the amphitheater and "drawn and withdrawn as the sky changed." It seems to be supposed also that these changes were effected by manual power alone; but the "American Encyclopedia" suggests that machinery may have been employed, which was located in the upper part of the building.

A very little reflection will show that the stretching and maintaining of such a canopy, to say nothing of drawing and withdrawing it, as the sky changed, would be a physical and mechanical impossibility. The strain of such an enormous fabric shaking in the wind would speedily have torn it loose from all supporting arrangements or have pulled the supports themselves out of place. Certainly the poles around the top of the wall, by which it is supposed to have been held, would have been totally inadequate. To draw the canopy to anything approaching a plane would have been impracticable by any machinery whatever, still more so by manual power. It would inevitably sag in the center, and every rainfall, however slight, would add immensely to its weight, while in case of a heavy shower, an insupportable body of water would collect in the middle, and if there were an opening there, would descend in a cataract upon the performers in the arena. Imagine also the terrific noise of such a canopy flapping and pounding in the wind and the constant fear of the spectators that it would break away and fall upon them!

If withdrawn, it must have been pulled across from one side, which would cause the other to descend upon the audience; and how and where would such an immense bulk find storage room? If, on the other hand, we suppose it to have been divided into triangular sections, with their apices meeting in the center, we shall encounter not only most of the difficulties already referred to, but others equally insuperable. In such case, the sections, being separated, could not support each other, and nearly one-half the weight and strain of each would come upon its apex, held only by the ropes which extended to the opposite wall of the amphitheater. Without enlarging upon this point, nor upon the difficulties connected with any possible contrivance for spreading and furling the separate sections, we may safely assert that no such supposed arrangement will bear examination.

The most intelligible explanation of the awnings is found in Middleton's "Remains of Ancient Rome" (ed. 1885, p. 321). After describing the projecting socketed corbels near the top of the outer wall of the Colosseum, and the holes through the cornice above them through which poles were passed, their lower ends resting in the corbels, the author proceeds as follows:

"Other corbels on the inner face of the wall held a corresponding set of masts. The upper parts of each pair of poles were about 6 feet 3 inches apart, being separated by the thickness of the wall. They were probably strutted and lashed together so as to form a stiff support, as the strain of the ropes of the awning must have been very great. The awning did not, as has been sometimes supposed, cover the whole amphitheater: a thing which would have been practically impossible, owing to the enormous strain of so long a bearing, far beyond what any ropes could bear. It simply sloped down over the heads of the spectators in the cavea (the seated portion of the building), leaving the whole central arena unshaded. Corbels to support the lowest masts exist in the outer wall of the substructures below the level of the arena. These poles rose out of the arena along the line of the fence wall that protected the podium (lower row of seats). There must have been many intermediate points of support at intervals up the slope of the seats, but no indications exist of any of these, owing to the complete removal of all the marble seats and decorations. A whole army of sailors were employed to extend and furl the awning."

In confirmation of this view of the arrangement of the awnings over the seats, I may add that some years ago, while inspecting in the museum at Naples fragments of wall plaster brought from Pompeii and scribbled over with "graffiti," or rude sketches of every sort, I observed one drawing which evidently represented several rows of seats in an amphitheater. Over the seats was distinctly shown an awning descending toward the arena, not in a line parallel with the slope of the seats, but with its lower edge somewhat elevated, as if to permit an unobstructed view of the arena by spectators on the upper row.

It will be observed, however, that if there were but a single awning extending over all the rows of seats from top to bottom of the cavea, whose lower edge was raised enough to meet the requirements of spectators on the upper seats, it would furnish no shade at all to those on the lower tier, and especially to occupants of the podium, which was the lowest tier of all and was reserved for the greatest dignitaries of the state. It is hardly probable, therefore, that Middleton is correct in assuming there was only one. In fact, the citations we have given above from Latin authors all refer, not to the "awning," but the "awnings" (vela). The explanation is simple, when the arrangement of the seats is understood, and any good picture of the Colosseum as it now appears is examined. "Chambers's Encyclopedia" says: "Besides the podium, there were three tiers or stories of seats corresponding to the external stories. The first of these is supposed to have contained twenty-four rows of seats and the second sixteen. These were separated by a lofty wall from the third story, which contained the populace." The picture will show that each of these tiers, or stories, was so far below the one next above it that a low awning over the lower tier would be entirely overlooked by spectators in the upper one; each tier of seats thus having an independent awning. By this arrangement not only would the arena be in full view of all the spectators, but the spectators would themselves all be visible from all parts of the arena. With a single awning, however, these conditions could not be secured, unless its lower edge were unduly elevated, especially at the two ends of the arena. We know that the performers were in fact able to see the entire audience, for victorious gladiators were expected to await its signals of thumbs reversed or otherwise, commanding death or life to the vanquished, and to be governed by the majority vote.

If the above theory is correct as to the plan of the awnings, it is evident that there was no occasion to "draw and withdraw them as the sky changed." Undoubtedly there was a corps of attendants, probably sailors, to look after them; but perhaps hardly "an army." It would seem that these attendants served as a police or military guard also, and as such took the order from the Emperor Commodus to fall upon the audience, which is referred to by Lampridius.

HENRY T. BLAKE.

New Haven, Conn., November, 1894.

Electric Heating of Cars.

In a paper read before the meeting of the American Street Railway Association at Atlanta, Mr. E. C. Foster, referring to the electric heating of cars on trolley lines, stated that his experience showed that to raise the temperature of such cars 40° F. above the outside air, as much energy was required as to propel the car, and hence is not economical.

Curious Forms of Money.

The cured skins of wild animals constitute one of the earliest forms of currency known, and, while employed in the most ancient times, are not yet disused in some parts of the world. Such a medium seems appropriate among those who subsist by the chase, as all primeval peoples must in some degree, and it is not, therefore, surprising to find that, in the transactions of the Hudson Bay Company with the Indians, the unit of value by which the price of other articles is reckoned is the beaver skin. Attempts at a bidermatic currency, which should also include the skins of otters, may have been made among these conservative aborigines, but if so, they have always failed. Other skins, it is true, as well as those of the marten, the Arctic fox, and many others, pass readily in that northern commerce, but their ratio of value is conscientiously determined by the beaver skin.

In the Portuguese possessions of Angola, before the year 1694, the circulating medium consisted of small mats woven from a species of straw, and which the natives called libongos. Each libongo represented a value of five reis. The substitution of copper coin for this curious straw money came near bringing about a revolution, and was the cause of the death of many.

The shells of certain mollusks have long been used as money among some peoples, and among such shells may be mentioned the cowry, which constitutes the money of the natives of English India, the Soudan, the coast of Africa, etc.

The American Indians of the Atlantic coast made their money, or wampum, from the shells of the round clam and the columella of a species of Buccinum. The use of this money extended at an early period to the far West, and the people of this part of the country received it in exchange for the products peculiar to their region.

Upon the Pacific coast the money was often formed of a mollusk that is very abundant upon the coast of the Vancouver Islands, the Dentalium entalis. The shells, which are naturally perforated, were strong, and used as an ornament as well as for commercial exchange. The monetary unit was the fathom, which was calculated from the length of the arms stretched out on each side of the body.

The Indians of Bear River use, as money, disks cut from the very thick shell of a species of Saxidomus. These disks are perforated and strong, and the money thus manufactured is called ha-wok.

Among the islanders of Santa Barbara, the shells of Olivella biplicata are employed as money under the name of kol-kol. A good horse may be purchased for a string of these shells.

As a medium of trade among the aborigines of California, sea-ears or abalones (Haliotides) have been highly esteemed both for their beauty and their importance when used as shell money, the shells in the latter case being cut into strips of from one to two inches in length, according to the curvature of the shell, and about one-third as wide as long. These were strung on a string and used both as money and ornaments. The string bore the name of uhl-o or aulone. As an illustration of the purchasing power of an abalone, it may be stated that in New Mexico a horse has been traded for a single shell.

From the reign of Henry I. down to the period of the establishment of the Bank of England, the legal tender money of England was fabricated out of wood. This instrument was called an exchange tally, and, by virtue of it, the holder was entitled to receive from the Crown the value prescribed thereon. It really consisted of one-half of a four-sided rod or staff, on which, when in its entire state, the sum it purported to represent was carved in transverse notches, varying in width for thousands, hundreds, scores, pounds, shillings, and pence. These signs were for the unlearned. For the advantage of those who could read, the sum was written in ink on two opposite sides of the staff, and, finally, with a knife and mallet the staff itself was split in two, longitudinally. One-half, called the tally or check, was given to the person for whose service it was intended; the other half, called the counter tally, was laid up for safe keeping until its corresponding tally should be brought in by the person who had last given value for it. Its intrinsic value was, of course, only that of the wood of which it was composed, but, by representation, it denoted large sums. It was a current token of real money, and served actually to distribute it from man to man by this exchange.

From this primitive tally was derived the Exchequer bill, first introduced in 1696, by Mr. Montague, the Chancellor of the Exchequer. The word "bill," too, was no doubt derived from the old French "bille," which means a staff. Bank post bills and bills of exchange in our own day come from the same wooden base, and soldiers in England are still said to be "billeted," because formerly they tendered wooden "billes" or tallies to the victualers upon whom they were quartered. In olden times, officers of the army who were taken into the king's own pay were said to be put on the staff, that is, they were paid with exchequer tallies, or wooden money.

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GEORGE HUNTINGTON WILLIAMS.

(Continued from first page.)

city. Thence he passed to Amherst College, where he was graduated in 1878, standing high in his class. He promptly began a post-graduate course, and then went to Germany, where, after preliminary studies in Brunswick and Gottingen, he settled in Heidelberg and devoted himself chiefly to the study of geology, and especially to petrography, which branch he pursued under the direction of the great Rosenbusch. His inaugural dissertation on the "Eruptive Rocks of the Vicinity of Tryberg in the Black Forest" gained for him in 1882 cum summa laude the degree of Ph.D. He returned home during that winter, and early in 1883 received an appointment as associate in the Johns Hopkins University, in Baltimore. Two years later he was advanced to the grade of associate professor, and in 1892 was given full possession of the chair, with the title of professor of inorganic geology.

From 1883 till his death—only a little more than a decade—he developed the course of study in his department and attracted students from all over the United States to the new university. If at the outset his inexperience as a teacher made him feel doubtful as to the results, the full classes that came to him soon dispelled all fears and were but a just tribute to his ability, tireless energy, and personal magnetism.

Dr. Williams also grew as a scientist. Maryland contains a representative of every geologic period from the earliest to that now in progress. Indeed, it may be said without exaggeration that no State in the Union contains a fuller geologic sequence, and there are few areas of like extent in the world where the record is so complete. He was quick to take advantage of this fact, and his earliest work was along the line of microscopic examination of the structure of the rocks of the vicinity. This was his specialty, and the United States Geological Survey promptly sought his aid. There is not space to even mention the titles of his individual investigations, and later more competent authority will discuss them in detail. We can only refer to a few of his larger researches. As early as 1886 the Geological Survey issued as a special bulletin his studies of "The Gabbros and Associated Hornblende Rocks in the Neighborhood of Baltimore, Md." (78 pp.), and in 1890 they published his work on "The Greenstone Schist Areas of the Menominee and Marquette Regions of Michigan" (241 pp.) From his work in Maryland grew the preparation of a geologic map of the State which, with researches on the crystalline rocks, have not, as yet, been completely published by the Geological Survey, but in 1892 he published through the Johns Hopkins Press two valuable maps of the vicinity of Baltimore, one of which was a topographic map, the other a geologic map. The latter was printed upon the topographic map to represent all the rock formations. Eighteen separate types were shown. The geological aspects of the neighborhood of Baltimore were popularly presented by him in an address entitled, "The University and its Natural Environment," delivered before the university authorities on Commemoration Day, February 22, 1892. It was about this time that he edited a "Guide to Baltimore" for the meeting of the American Institute of Mining Engineers held in that city, which contained his valuable paper on the "Geology of the Crystalline Rocks," together with two maps made by him. Prof. Williams also prepared "Notes on the Microscopical Character of Rocks from the Sudbury Mining District, Canada," for the Geological and Natural History Survey of Canada.

His entire bibliography, as published in the "Bibliographia Hopkinsiensis," includes some seventy-two titles. Besides the papers previously mentioned, his "Notes on the Minerals Occurring in the Neighborhood of Baltimore" (1887) and his "Geology and Mineral Resources of Maryland" (1893), deserve worthy notice, and also his more recent "Geology and Physical Geography of Maryland" (1894). He was the author of "Elements of Crystallography for Students of Chemistry, Physics and Mineralogy" (New York, 1890), and for which he made all the drawings. This book has been said to be "the best text book on the subject written in this country." At the time of his death he had in preparation a work on the microscopic structure of the rocks of North America, for which he had accumulated much material.

Professor Williams was a member of the International Jury of Awards in the department of mines and mining of the World's Fair held in Chicago during 1893, and in connection with the special exhibits of his State edited the work entitled "Maryland: Its Resources, Industries and Institutions," which was published by the State Board of Managers for the World's Fair Commission. He also wrote the "Mineral and Petrographical Exhibits at Chicago" for the American Geologist. His other editorial work included the supervision of the terms in mineralogy and petrology for the "Standard Dictionary," also he was on the staff of the present revision of "Johnson's Cyclopedia," and he was an associate editor of the Journal of Geology.

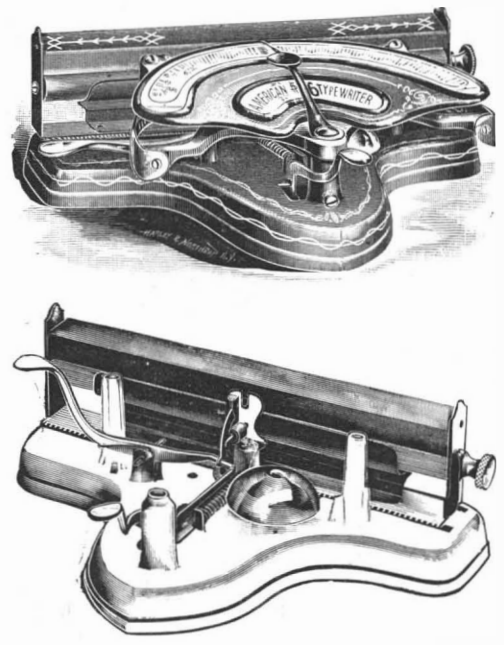
He was a member of many scientific societies, and among these may be mentioned the Geological Society of London and the French Mineralogical Society abroad. While at home, besides his membership in the American Association for the Advancement of Science, he was connected with the Geological Society of America, in which organization he held the high office of vice-president at the time of his death. Professor Williams was also a member of the International Congress of Geologists, and when that congress met in Washington in 1891 he was one of the managers who conducted its members on the excursion to the canyon of the Colorado.

In April of this year he was called upon by the United States Geological Survey to prepare a map of the Potomac River and Chesapeake Bay, and at the close of his work at the university, in order to secure certain necessary material, he made a trip down the Potomac River. Then he went to Utica to visit his parents before taking his much-needed vacation, but in a few days he was taken ill with a malarial fever, which soon developed into typhoid and terminated fatally on July 12. A career which seemed to hold the certainty of further and more golden fruition was thus prematurely brought to a close. He had accomplished so much in the few years of his active life that there seemed to be no professional heights to which he might not hope to soar and no honors too great but that he might hope to receive them, and yet the cherished ideals of his life were but half attained when the end came. How few of us have done so much with the talents at our disposal!

In the autumn a meeting was held in Baltimore at which his colleagues paid reverence to the memory of their deceased associate, and a committee was appointed to select a suitable permanent memorial commemorative of Professor Williams. This will, in all probability, be a portrait which will be hung in McCoy Hall of the Johns Hopkins University, in honor of the young scientist who did so much for the glory of American geology.

THE AMERICAN TYPEWRITER.

The typewriter shown in the annexed illustrations has the merit of being one of the least complicated in-



THE AMERICAN TYPEWRITER.

struments yet invented for the purpose, and notwithstanding its great simplicity, it will do work that does not suffer by comparison with that done on costly and more complicated machines. The alignment is perfect, and the letters and characters being printed directly without an inking ribbon, are clear and distinct.

The machine has all the advantages of high-priced machines, with exception of great speed and manifolding; still, with practice, work can be done quickly and neatly. The machine is well and strongly built, and the working parts are few and not delicate. It has a paper feed that is all that can be required, and there is nothing about the machine that is liable to break or get out of adjustment.

Although this typewriter is adapted to commercial work and general writing, it would seem that the low price would make it available for young people. In the hands of a bright boy or girl a machine like this is one of the best of educators.

The manufacturers state that in the short time this machine has been on the market the sales have reached 3,000, all of which are giving good satisfaction. The machines are made by the American Typewriter Company, of 267 Broadway, New York City.

Alcohol from Apples.

Vivien and Dupont have experimented as to the manufacture of alcohol from apples. One hundred quarts of apple juice, weighing 233 pounds, contained 89·75 per cent of water, 0·30 per cent of ash, 2·04 per cent of pectin bodies, and 2 per cent of cane sugar, 2·97 per cent dextrose, 8·50 per cent levulose, and 0·84 per cent. of other sugars; total sugars, 14·31 per cent. On adding phosphoric acid, potash, and ammonia (or sodium nitrate) the fermentation proceeds as quickly and completely as with turnip juice, and by this means 5 per cent of alcohol is obtained from the apples. This alcohol was considered to be of better quality than the ordinary alcohol from cider. The grounds remaining compose 18 per cent of the apples taken, and contain 2·5 per cent of sugar.

What is Your Weight?*

Many persons weigh themselves frequently and imagine that they know their weight. Sweet illusion! Nothing is more difficult than to know one's weight exactly, even with access to first class scales. We hear one say, "I am making flesh, I have increased 2 pounds;" and another, "I am getting into form, I weigh 3 pounds less;" but while I do not wish to make myself disagreeable, especially to people who keep account of their weight, I am convinced that in most of such cases there is really not an ounce of gain or loss; or, if there is any variation, it is not what the scales record. A lady goes into a store, weighs herself, and receives a card: August 15, 120 pounds. She goes to the country, and returning after several months weighs herself again in the same store and receives a card, on which she finds inscribed: November 22, 126 pounds. She has gained 6 pounds in three months and ascribes it to the change, the fresh air, etc. She feels happy—good weight, good health. But is this increase real? In nine cases out of ten it is only apparent, due mainly to wearing more or heavier clothes, thicker boots, etc. The ordinary methods for determining variations in weight give absolutely fallacious results. The causes which influence weight are numerous, and rarely taken into consideration. For example, was the weight taken immediately after breakfast, or long after? Or following active exercise attended with free perspiration? Again, many people, even educated people, have extraordinary ideas as to what affects the weight of the body. Have you not been asked more than once if it is true that one weighs less after meals than before? As if every additional weight in the pocket or the stomach were not necessarily revealed by the balance. The fact is that people are in the habit of weighing themselves, for good luck, one day after breakfast, another day before dinner, another day with heavy clothes on, another day when it rains, etc. Add to this the errors of the scales, and who can say that he knows exactly his own weight or range of variation? One's weight is like a mobile expression—it changes every instant. The study of this matter is, nevertheless, of considerable physiological and hygienic importance—a fact of which I have become thoroughly convinced in the course of over ten years' investigation of the subject.

The inaccuracy of ordinary balances, such as one finds in hotels, at railway stations, etc., determined me to make a portable balance to weigh a hundred kilogrammes (220 pounds), and to be exact to within an ounce, and since then I have weighed myself regularly every day at the same hour in the morning and under identical conditions, and to-day I possess a record of five years of experiments conducted with the utmost precision. Every day when weighing myself I record the barometric and hygrometric variations, the temperature, and the dinner menu for the day. These experiments have convinced me more than ever that our weight is in a perpetual state of fluctuation. After eliminating the errors of the instrument, our weight varies, subject to innumerable influences. After breakfast, on a warm day, one loses more than 150 grammes an hour. How then are you to arrive at your true weight when it is subject to such incessant fluctuations? When we remember that 70 per cent of our body is water, there is little difficulty in understanding that our weight must vary continually with the transpiration of moisture; moreover, it varies with the pressure of the atmosphere. The mere variations in atmospheric humidity suffice to account for a change of more than a pound, and other causes may suffice to account for another pound.

The person who weighs only at intervals may infer from this that he is growing lighter or heavier, but the conclusion is unwarranted. There are some people, on the other hand, who will tell you that their weight never changes. This, too, is an error; it is constantly fluctuating. The fault is generally that the scales used do not record variations of a pound or so. For ordinary purposes this is of no consequence, but for recording changes of weight in sickness it is of very serious moment. The scales are not without their importance in medical practice, especially with infants. The weight of an infant increases in definite proportion during the first weeks of life, and there can be no departure from this regularity of increase without impairment of health. For adult persons, too, it is good to consult the scales, for they are the barometer of health. Any sudden increase of weight, amounting to a pound or so in a day, indicates a tendency to disease. It is evidence of health when the weight does not fluctuate more than three or four ounces from day to day. Great fluctuation implies functional derangement.

*Dr. Henri de Parrville, in Le Correspondant.

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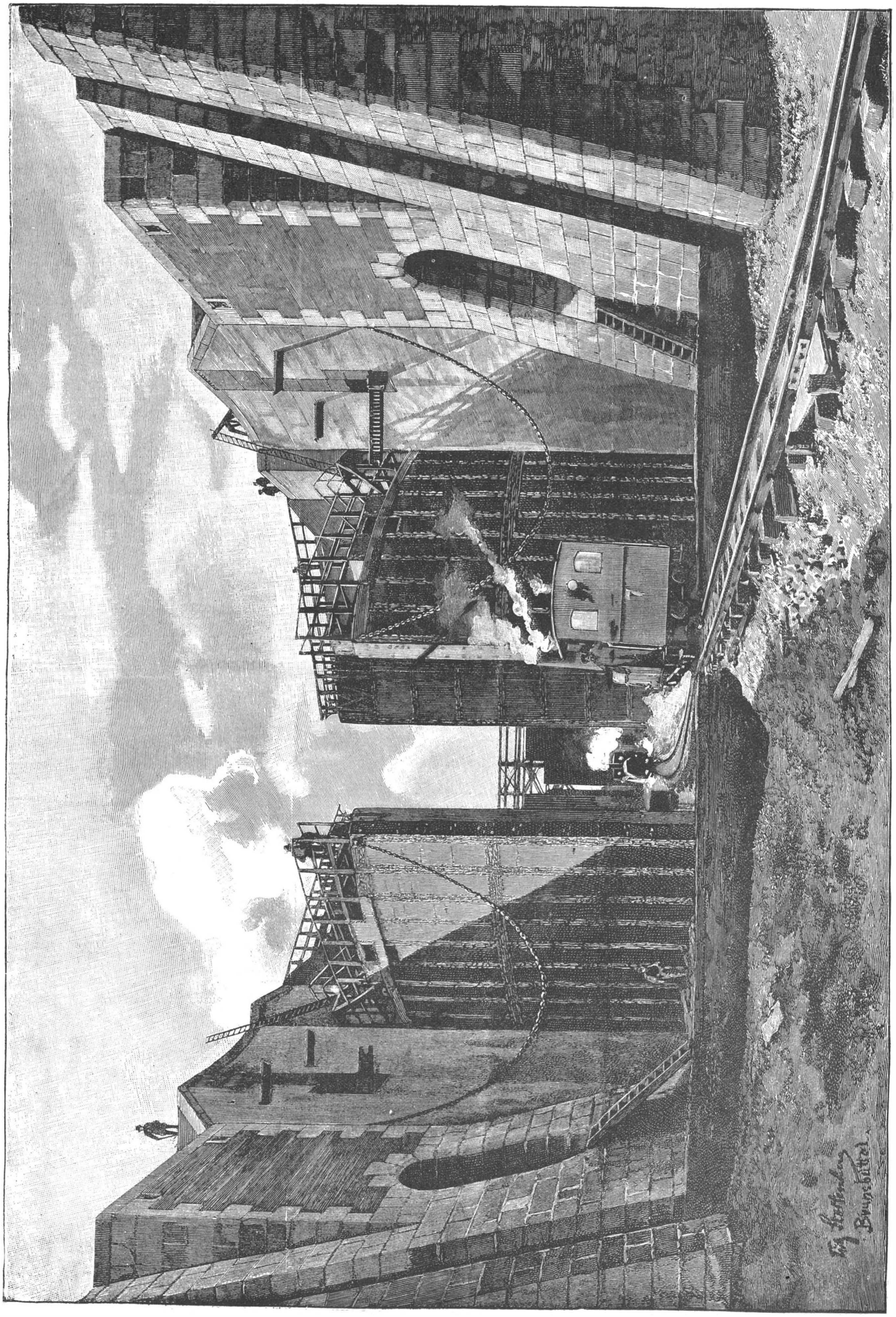

INTERIOR OF BASIN IN BRUNSBUTTEL LOCK.

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THE LOCKS AT THE ENDS OF THE CANAL BETWEEN THE NORTH AND BALTIC SEAS.

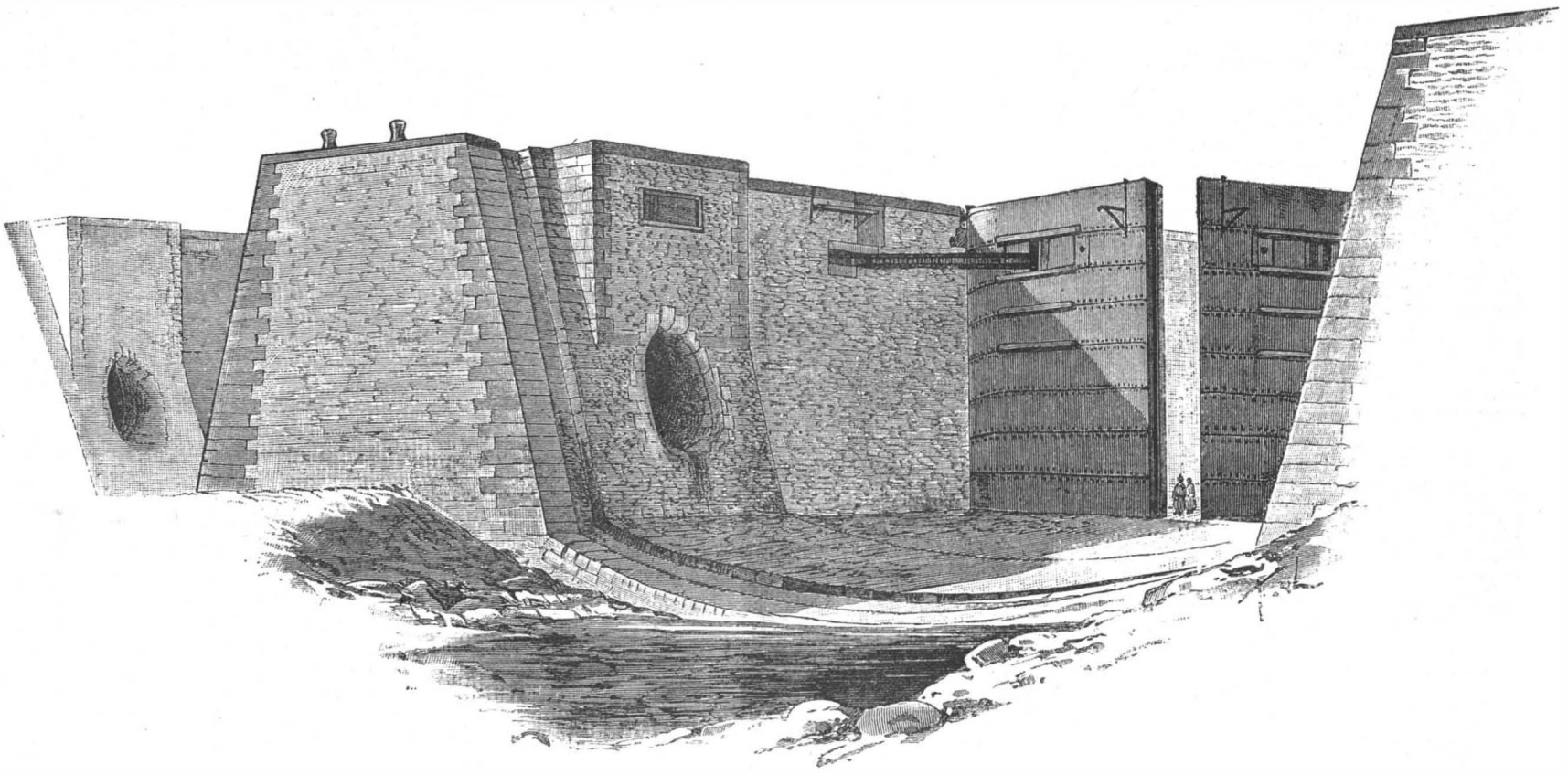
We are now separated only by months instead of years from the day on which this great canal—so important as a means of defense and also from a commercial point of view—will be opened to the world. We publish herewith some engravings which will give the reader an excellent idea of the present condition of the locks at the ends of the canal, and a little explanation in connection therewith will not be out of place.

Next June, or July at the latest, the canal will be ready for business. Just eight years will then have passed since the laying of the corner stone on June 3, 1887. On September 1, of this year, the chambers or basins of the lock on the Baltic Sea, near Kiel-Holtenau, were filled with water that was brought beforehand from the Eider Canal by means of culverts, and was dammed up to a depth of about 37 feet; so that one of the most interesting portions of the structure is now forever removed from sight; a smooth, mirror-like surface stretches over work that required years for its completion, only the massive tops of the masonry showing above the water.

The northern basin of the lock will be arranged for vessels entering from the Baltic and the southern one for vessels passing from the canal to the Baltic. The dimensions of the new lock are enormous; the available space between the gates is about 492 feet, the greatest breadth 82 feet, and the depth 32 feet. Vessels 492 feet long can pass through the lock, while our largest war vessels are not more than 367 feet long and 68 feet wide, having a draught of 27 feet 10 inches. The largest transatlantic steamers measure 557 feet 8 inches in length and 72 feet in breadth, with a draught of 26 feet.

Excepting the locks at Bremerhaven, there are no others as large in the world. In the Kiel-Holtenau lock, which is of about the same size as the lock at Brunsbuttel, several steamers or sailing vessels can pass through the two chambers at the same time.

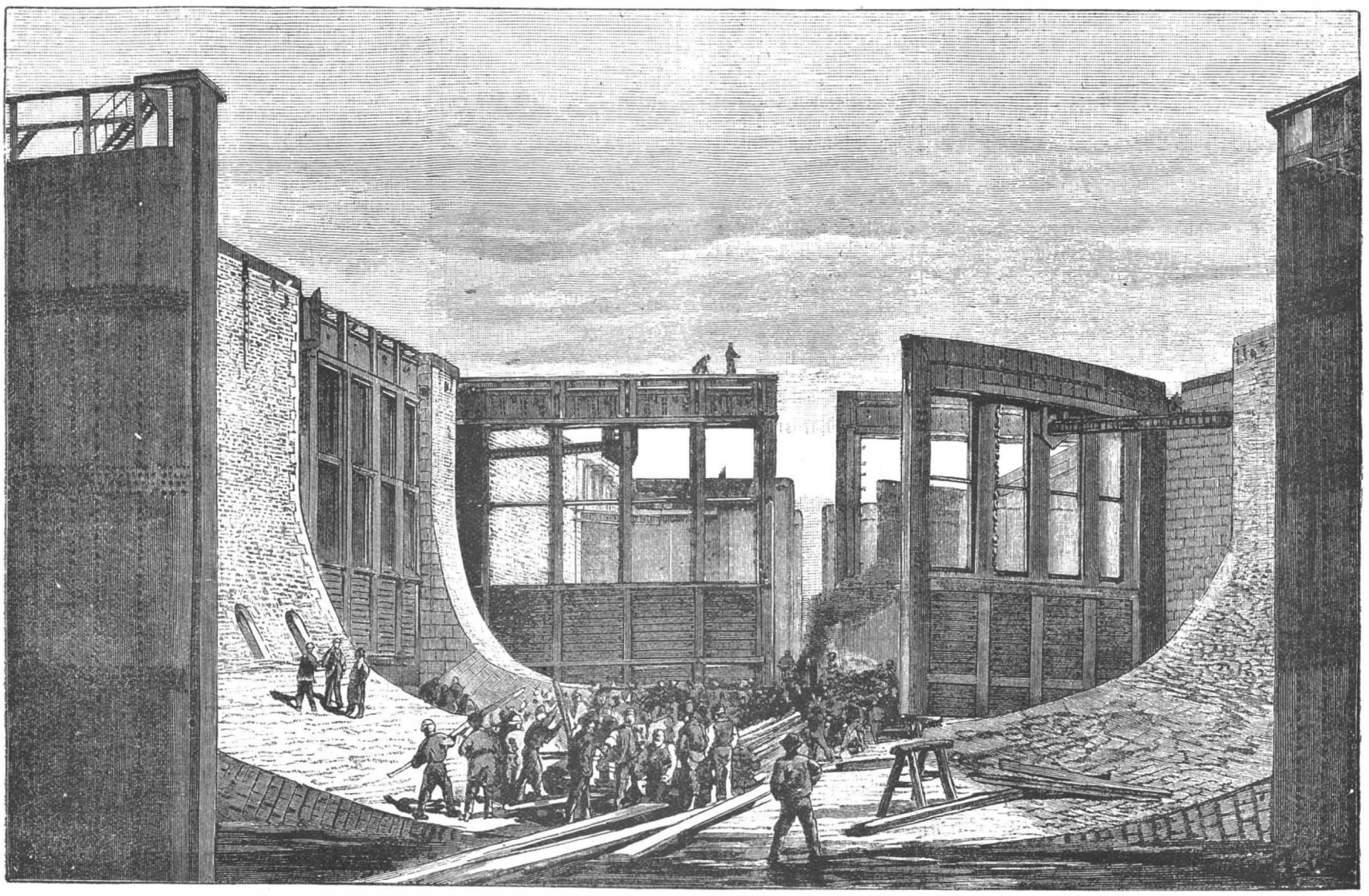
The locks are operated by hydraulic power. In the center of the basin there are light, inswinging gates, calculated to relieve the main gates of part of the pressure in case of high tide or other emergency. Eastward of the old Holtenau lock the canal widens to over 300 feet and forms an inner harbor that connects with the harbor on the north side where the government collects its revenues, and from here opens into the double lock. The locks will generally be open, for there is no flood tide in the Baltic Sea, and will need to be closed on special occasions that will not amount to more than twenty-five days in the year, while the lock on the North Sea can be kept open only three or four hours during each flood tide.



THE NORTH SEA—BALTIC CANAL—HOLTENAU LOCK.

With the completion of this lock we reach an important point in the construction of the canal, which is rapidly approaching its conclusion, and the celebration that will mark this important day.

Let us now turn our attention to the Elbe lock. From the Elbe one passes first to the outer harbor, which, at the quays on the western and eastern sides of the Elbe, measuring 1,509 feet and 918 feet respectively, offers accommodation for ships waiting to pass through the locks. This outer harbor is more than 300 feet wide and opens into the immense double lock.



INTERIOR OF BASIN IN HOLTENAU LOCK.

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Beyond the Elbe lock stretches the inner harbor, which is about 1,557 feet long by 656 feet wide, at the widest place, and then narrows down to the regular width of the canal; that is, 229 feet.

But let us return to the lock. The two basins are contiguous and parallel, and each basin is provided with three sets of gates that are to be closed every four hours. The foundation of the Elbe lock was built mostly dry. The walls consist of brick and square blocks of stone, the latter showing in some parts, while other parts of the visible portions of the walls are covered with cement. The projecting corners, sills, recesses for the gates, and other trimmings are made of stone. In the Brunsbuttel lock there are altogether 103,332 square yards of masonry. The walls are provided with supply channels to be used in filling the locks, the water for this purpose being taken from the inner harbor. These channels can be closed watertight. Pontoons will be used for closing the basins watertight in case repairs are being made. In this lock, as in the lock at Holtenau, there are the necessary hydraulic motors and other machinery, all operated from a central machine station. The illustrations, for which we are indebted to the Illustrirte Zeitung, show the interiors of the locks.

About Engravings.

Not every one who reads the newspapers and looks at the engravings in print knows how they are made or what process is used in producing the different effects. The Newspaper Union undertakes to tell how the variety of kinds are produced:

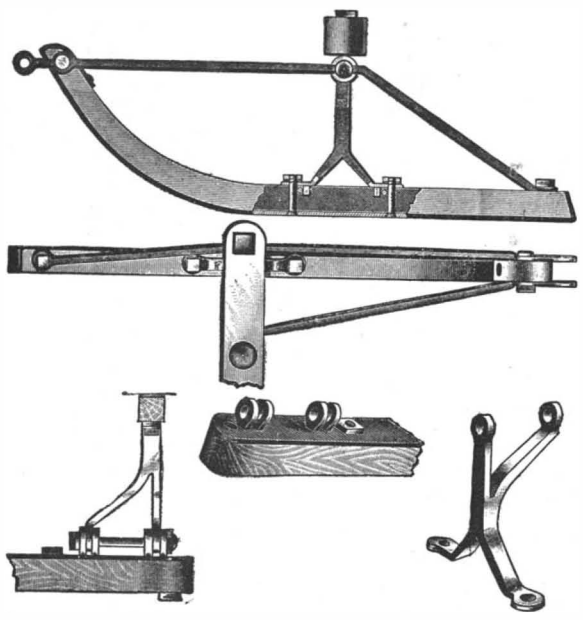
A half-tone is made direct from a photograph, and is the closest possible counterfeit of the original that can be produced. It is not suitable for newspaper work, but works well on any supersized and calendered stock. An electro from this necessitates a separate operation, and the price of an electro does not include the making of the half-tone.

A zinc etching is made only after the subject is first plainly shown in black ink upon white paper. Pen and ink drawings of original drawing subjects are indispensable, and may be made either from a photograph or other illustration. This drawing is photographed upon zinc, the superfluous metal eaten away by acids, and an electro is made from the skeleton which is left. Price of the drawing and zinc etching is not included in the price of electro. Zinc etchings are suitable for newspaper work, and are inexpensive.

Woodcuts are made only by drawing upon wood, and cutting out superfluous portions. They are necessary only for the finest work, not so good generally as half-tones, are slow to make, and expensive.

AN IMPROVED SLEIGH KNEE.

The illustration represents an improvement in sleigh construction for which a patent has recently been granted to Mr. L. L. Chaffin, of Monticello, Minn. The attachment of the knee to the runner is shown in one of the views, and the knee itself, shown separately, is forked at its upper end, spaced groups of bearings rigid with the beam receiving the upper forked arms of the knee between themselves, where they are held by a pivotal bolt. A continuous brace, having an eye through which the pivotal bolt is passed, is fastened



CHAFFIN'S SLEIGH KNEE.

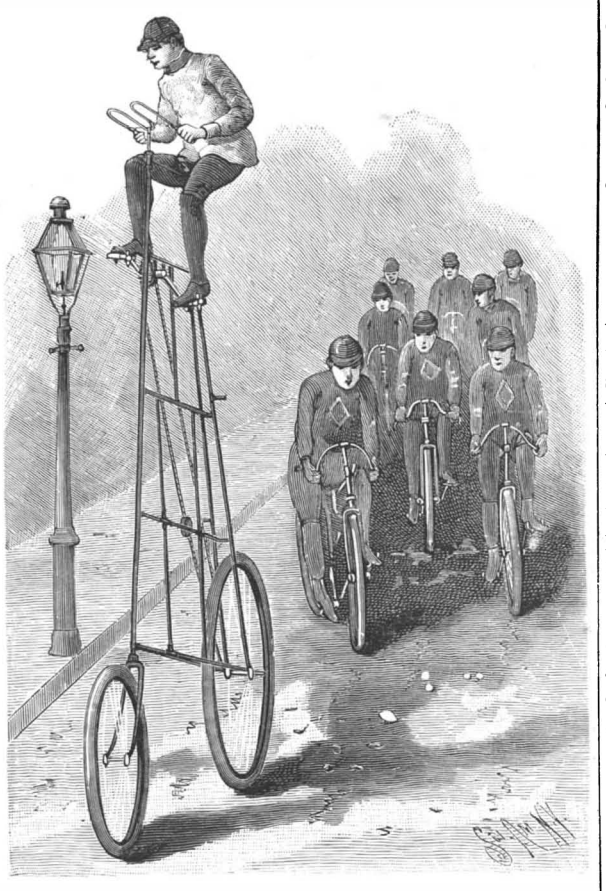
at its front and rear ends to the runner, and another brace extends diagonally from the front end of the runner to the inner end of the bolt.

The Shepherd's Telephone.

The use of the telephone on Australian sheep ranches is becoming common. Its employment is mentioned on the Clark ranch in Montana, where all the sheep and shepherds are watched and handled telephonically, by means of six stations all communicating with a central point, from which come weather signals, orders, etc.

A CURIOUS BICYCLE.

One of the most curious sights that has lately been seen in the streets of New York is what has felicitously been called the Eiffel Tower Bicycle. This machine is constructed on the same principle as an ordinary safety, but it has a frame superstructure which carries the rider at a distance of some ten feet from terra firma. This machine is frequently seen on the avenues of the city, and the rider easily overtops the ordinary lamp post along the route of travel. He seems to have



THE EIFFEL TOWER BICYCLE.

perfect control over the machine, which he can drive at quite a good rate of speed, taking sharp corners with perfect ease and apparent safety. This bicycle is mounted from behind in the usual way, but it has to be held by attendants while mounting. The owner sometimes places the machine against a wall and mounts from a standstill, but, of course, in the city this is not always practicable.

There is considerable difficulty in driving the bicycle up hill, owing partially to the weight, the length of the sprocket chain and the balance of the machine. The sprocket chain extends from the upper sprocket wheel to the rear wheel, and the lateral swing or play of the chain is prevented by a guide roller mounted just above the back wheel. The front wheel measures 28 inches, the rear wheel 36 inches, and the extreme height is said to be 13 feet. The machine was constructed in England, but the American Dunlop tire was applied after it arrived in this country. The adventurous spirit who has been seen riding this remarkable wheel is usually accompanied by a number of companions who serve as a sort of bodyguard and prevent vehicles and pedestrians from obstructing the way.

Natural Soda in California.

California is one of the few localities in the United States where natural soda is found. The geographical occurrence of this substance in the United States is principally confined to the arid regions of the Great Basin, especially to the soda lakes near Ragtown, Nev.; Mono Lake, Mono County, and Owens Lake, Inyo County, Cal.; and Albert Lake, Or., and to many dry deposits and incrustations in the same region. A full chemical discussion of the nature of natural sodas and their technology, together with numerous analyses of the waters of the soda lakes and dry deposits, are given by Dr. T. M. Chalard in Bulletin No. 60 of the United States Geological Survey. The lakes, as shown by Messrs. King, Hague (fortieth parallel, II.) and Russell (Eighth Annual Report and Monograph XI., United States Geological Survey) are, for the most part, the residues left by the evaporation of larger bodies of crates, the shore lines of which can be traced at considerable distances, sometimes several hundred feet above the present beaches, showing that the old lakes covered wide expanses of the present desert.

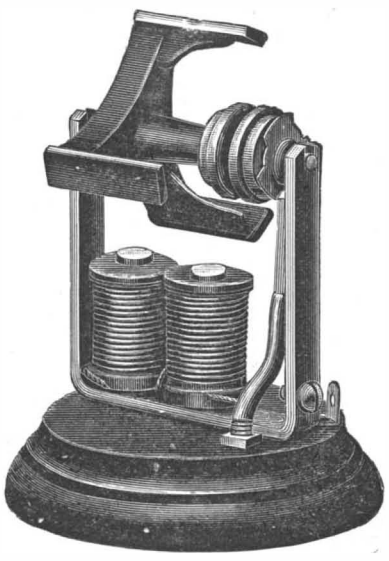
The concentration by evaporation of the waters of the former lakes has increased the proportion of their mineral salts, and sometimes this concentration reaches the crystallizing point, when the sodium carbonate appears as a white incrustation on the surface and shores of the lake. The origin of this salt is explained by the geology of the region where it occurs, which is given in the reports above referred to. Mono and Owens Lakes, in this State, are outside the great hydrographic basin of Lake Lahontain. Professor Russell describes the geography and geology of Mono Lake in the Eighth Annual Report of the United States Geological Survey. Its hydrographic basin has no outlet, but streams and springs feed the lake, and the only escape for the water is by evaporation. The ancient shore lines can be traced far up on the sides of the Sierra Nevada, which formed the western shore of the ancient lake. There are springs in the bottom of the lake and near its shores. They are especially abundant near the base of the mountains—the seat of former orographic movements—and a belt of hot springs extends along the range for hundreds of miles. Just south of the lake is a series of volcanic cones known as Mono craters, so that the locality is one of former volcanic activity. The high saline contents of this and other lakes is due to the gradual concentration of its own water supply.—Min. and Sci. Press.

Guard Rails.

The Roadmaster and Foreman says: "We were very much interested in the New England Roadmasters' Association's report on guard rails. The conclusions of the committee were about in accordance with the usual practice on the best roads of the country. The length of guard rail recommended is not less than 12 feet. But we rather like the length of 16 feet. The purpose of the guard rail being to so guide the wheels that they will not take the wrong side of the frog, or pass over it with unnecessary jar, it is plain the guard rail need only be long enough to produce this result. Any additional length is mere waste. For all practical purposes 16 feet is sufficient. With this length we could have a curved portion of four feet at each end and a straight portion of eight feet in the middle. A curvature of two inches at the end is sufficient. No greater mistake can be made than in having the curve at ends of guard rails too stiff. When the curve is short and stiff, the approaching wheel strikes the guard rail at such an angle as to impede its progress, and cause a very decided jerk. As evidence of this note a guard rail that has a very stiff curve. Not only does it cause a jerk when the wheel strikes the guard rail, but the wheel is veered out of its proper position, and before it rights itself a succession of jerks follow that are injurious to the track and rolling stock. It is therefore very important that the curve be as slight and gradual as possible, so that the sides of the wheel flange will strike the guard rail and glide along without any jerk, or without being retarded until it reaches the straight portion of the rail and passes over the frog without any jerk or jar. Everything should be so arranged that the wheels will pass over the frog squarely, and the only way this can be accomplished is to have nothing impede the progress of one of the wheels. The more gradual the curve, the more nearly this can be secured, as there is no facing surface for the edge of the flange to strike. Careful attention to these little details in the arrangement of the guard rail will save time, trouble and expense."

SIMPLE ELECTRIC MOTOR.

The electric motor shown in the annexed illustration is capable of use for driving mechanical signs, toys, and other devices requiring a very small amount of



SIMPLE ELECTRIC MOTOR.

power; but it finds its principal use as an instructive toy.

It is provided with a bichromate battery capable of developing sufficient current for running the motor at a high rate of speed. The armature can readily be detached so as to permit of using the field magnet for experimental purposes.

The entire apparatus, including battery and a few charges of bichromate of potash, is furnished for $1, a common tumbler being used for the battery cell. This motor is manufactured by the Wood Novelty Concern, of 46 Cortlandt Street, New York.

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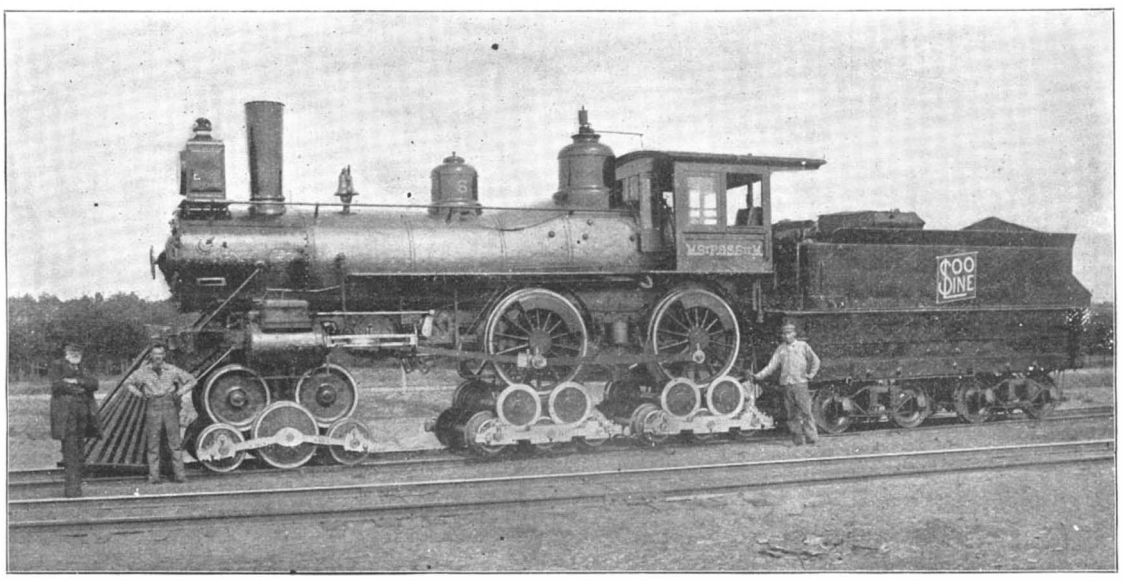
Hazing a Custom to Abolish.

The Western Druggist makes this pertinent inquiry: "Is the spirit of savagery creeping into our American universities? Hazing, in all conscience," the writer goes on to say, "is bad enough, and barbaric enough; but what must be the mental condition of 'students' who would run the risk of committing murder for the sake of indulging in a 'practical joke'? Not enough that chlorine gas was discharged with fatal effect into a hall filled with students of Cornell University; not enough that this crime found its imitators in the university at Lawrence, Kan., where bromine was similarly used (charged, in both instances, to the students of the pharmacy departments); now the list of these heinous jokes has been extended by the action of undiscovered individuals who burned a lot of cayenne pepper in the rooms occupied by the lady students of Northwestern University at Evanston, Ill., causing untold suffering to the students there assembled in meeting, and even prostrating a number who had inhaled a larger proportion of the penetrating, irritant fumes. The authorities are derelict in the execution of their duties if they do not discover the perpetrators of these crimes and make such an example of them as to deter in the future all evil-intentioned imitators."

THE HOLMAN LOCOMOTIVE.

So much has recently appeared in the columns of the daily press and also of the European technical press in connection with the so-called "Holman" locomotive, and its trial by the Minneapolis, St. Paul and Sault Ste. Marie Railroad Company, that definite information concerning same will no doubt be appreciated by the railway world and others interested. As will be seen by the accompanying illustration, reproduced from a photograph taken in the yards of the "Soo" Railway, the "Holman locomotive" in question is not a locomotive at all. On the contrary, it is one of the railroad company's regular 17x24 inch, eight wheeled Baldwin locomotives, placed on experimental trucks, for the purpose of demonstrating the possibility of decreasing the piston speed for a given rate of progress. The railway company is not interested in any manner in this device, the engine simply being leased to Mr. Holman for the above mentioned purpose. The engine up to date has not been in service except for a few days in the yards of the company at Minneapolis, although it is expected that a road trial will shortly be made. Without expressing any opinion as to the merits of the device, it would seem that even for the purpose of demonstrating the theory it would have been better to have dispensed with the front set of Holman trucks and obtained the necessary height for the front end of the locomotive by blocking on the top of the ordinary engine truck. This would have avoided much of the complication which at present attaches to this experimental device, and rendered it much less liable to accident. When the actual trial occurs, we will endeavor to supply our readers with a full account of the performance of the engine.—The Railway Review.



THE HOLMAN LOCOMOTIVE.

Standard Screws for Watches.

A general meeting of the Institution of Mechanical Engineers was held in London, October 24, the president, Professor Alexander B. W. Kennedy, occupying the chair. One of the papers read and discussed was "The Manufacture of Standard Screws for Machine-made Watches," by Mr. Charles J. Hewitt, of Prescot.

Mr. Hewitt's paper, remarks Nature, was of an interesting nature. He is the works manager and chief mechanic of the Lancashire Watch Factory, an establishment recently started at Prescot for the manufacture of watches on a large scale in one works. The factory system of watch production has been, as is well known, carried to a very successful issue in the United States, where the Elgin and Waltham Watch Companies annually make large numbers of excellent timepieces wholly by machinery. As in all cases where highly skilled hand labor, performing intricate operations, is superseded by mechanical appliances, the machines used are of a highly organized and costly nature. In the case of the minute parts required in watch making, this feature is very strikingly emphasized. Perhaps some of our readers may remember the exquisite little machine tools exhibited by the Waltham Watch Company at the Inventions Exhibition, in the year 1885. These were a revelation to most English watchmakers, accustomed to the small factories and perfectly rude appliances of the British industry, in which the highest skill of the operators, due to special training from earliest youth, compensated for the lack of ingenuity displayed in the construction of the tools used. In the case of watches, as with so many other mechanical productions, the brain capital expended in the employment of construction of machines bears fruitful interest in the shape of less skilled labor required in their use. The same thing may be observed throughout the whole range of mechanical industry. The file, the hammer, and the chisel are the primitive tools of the engineer, requiring simple inventive power in their inception, but great skill in their use. The planing machine, by which the same end is obtained mechanically, of producing a flat surface, as was got originally by chipping and filing, required knowledge and skill for its production, but a comparatively small amount of those qualities for its operation. The same thing is true, even to a greater extent, in the case of the still more modern machine tool, the milling machine, which is often attended by boys, possessing no mechanical knowledge whatever, during its production of finished forms such as would have required a highly skilled workman in former days.

The beautiful machines referred to by the author in his paper, examples of which were shown at the meetings, carry the same principle many steps farther. As was remarked, the machine shown for making watch screws may be said to stand in the same relation to ordinary engineers' machine tools as costly gems to common building stones.

Mr. Hewitt commenced his description by dwelling upon the difficulties experienced by watchmakers in old times, when there was no general standard for dimensions and pitch of screws, or form of thread. Such was necessarily the case with hand work, but a machine can be depended upon to turn out many thousands of parts exactly similar, so that a screw could be put into a watch made years previously. The advantage, naturally, is most apparent in the case of repairs and renewals. The standard of screws adopted by the Lancashire Watch Company, at their Prescot Works, is that recommended by the committee of the British Association, and described in the report of 1882. It is a V-thread of 47½ degrees, rounded top and bottom through $\frac{2}{11}$ of the height, and the pitch is directly related to the diameter of the formula $D=6P_s$. In arranging the standard the first business was to make master taps, which were produced on a small screw cutting lathe specially designed for the work, and having a corrected screw, accurate within very close limits. Taps being thus produced, screw dies were made to the exact standard. When cut the thread requires hardening, and this causes some amount of distortion, which is corrected by grinding the threads with a soft steel lap charged with diamond dust, the operation being performed in the same lathe that cuts the thread. The die used is simply a tapped hole in the center of a small thin disk of steel, it being an object to have as little metal as possible surrounding the hole, so as to reduce the distortion produced by hardening. Although the die is not split, the pressure exerted by the die holder is sufficient to produce a slight modification in the diameter of the screw, and in this way the alteration caused by hardening is corrected. During the discussion this fact was questioned, but Mr. Hewitt says that the statement is absolutely correct. The machine itself is of an intricate design, as may be imagined when it is stated that perfect screws are turned out automatically from the plain rod or wire. There are four hollow spindles through which this wire is fed forward to the operating tools, which are four in number, and are carried on a revolving turret. There is also a further tool for making the slit in the screw head for the turn screw. It would be useless to attempt to describe the mechanism of this very ingenious lathe without the aid of elaborate drawings. Indeed, during the discussion several engineers, well skilled in mechanical appliances, confessed themselves unable to follow the train of mechanism, even with the aid of working drawings displayed on the walls of the theater. It is enough to say that the machine will go on without any attention so long as the wire to form the screw lasts, when it stops of itself.

The Goodwin Sands.

Midway between the North and South Forelands, and right in the fairway track of the most crowded marine highway in the world—the road that leads to London—says the Nautical Magazine, lies that famous shoal, the Goodwin Sands.

There are few larger shoals off the coasts of the United Kingdom. Their extreme length, northeast and southwest, is 17,980 yards, or very nearly ten miles and a quarter, and their greatest breadth 7,669 yards, or a trifle more than four and a quarter miles. The area of the reef which is exposed at dead low tide is a little more than two-thirds of its entire surface, that is to say, two leagues and a quarter in length and about a league in width. Few more erroneous notions exist than the popular idea that the Goodwins are a quicksand. The nature of the particles is, indeed, as firm as the beach of the seashore, and when the yellow ridge has been long enough uncovered to become dry it may be walked upon with security and comfort. No doubt the quicksand theory originated with the discovery that wrecks which become stranded upon the Goodwins gradually settle away out of sight. But it is the nature of all sand when it gets wet to grow of an absorptive character, with a tendency to suck down any object resting upon the surface. Then again, the insidious process of silting caused by the ceaseless flow of the current has much to do with the seemingly mysterious disappearance of vessels upon this shoal.

The character of the various strata of which the Goodwin Sands is composed was revealed by a very interesting experiment made at the instance of the Brethren of the Trinity House by Sir J. H. Pelly, in the year 1849. The purpose of the undertaking was to determine the geological formation of the sands, and to ascertain on what bed they rested. In order to carry out this scheme an iron cylinder of two feet and a half in diameter was constructed in ten lengths, and sunk by the application of atmospheric pressure until it had gone down a depth of seventy-nine feet, when it was stopped short by coming to the solid chalk. The results of this boring are very interesting, as establishing the exact nature of the famous shoal. For the first ten feet nothing came up but pure, bright sand. From this depth up to forty-six feet sand continued to be bored through, turning gradually to the color and substance of blue clay, with a strong sulphureted smell. At fifty feet fine shingle, intermingled with broken shells and chalk nodules, was found to exist. Six feet deeper came another stratum of clear sand, then in successive layers for the next twelve feet, clear broken shells, decayed wood, sea coal, fine stones and shells; dark, rank-smelling sand, more shells, and black nodules of clay. At seventy feet was again found clear, bright sand, containing many small pebbles, and permeated with chalky water, and this continued to the solid chalk at bottom.

Ornamenting Glass.

The following is an example of the means of carrying out the inventor's process: A coat of acid resist is laid upon the glass; from the parts forming the background to the design the "resist" is removed with a stencil; soda and hydrofluoric acid are then poured upon the surface. Hydrofluoric acid is next applied; the resist is then removed and the glass is cleaned. The glass is next coated with stain, and by means of a stencil the ornament is freed from the stain, which remains as a protection for the background. The stain is then burnt into the glass. The glass is then taken from the kiln, cleaned, and the required outline traced upon the glass, the background being filled with acid resist. The solution of soda and hydrofluoric acid is again poured on so as to leave a white "mat" on the whole ornament, leaving the outline, which is protected by the resist, clear. The shading-in is then done according to the ordinary process of the trade.

A SOCIETY has been recently established in Chicago entitled "Association of Practical Electricians." The object of this organization, of which Mr. George E. Sanford is president, is the education and advancement of men engaged in electrical work.

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New Method of Casting Iron.

The American Architect and Builder copies from La Revue Industrielle a description of a new method of casting iron. It is well known, the editor adds, that iron castings are very liable to "blowholes," "cinders" and so on, which occur in the middle of the mass and destroy its strength, or at least its appearance. These defects are caused by particles of scoriæ, oxide or other impurities, which flow out of the melting furnace into the ladle, or are formed by the contact of the hot metal with the air or with the sand of the mould; in fact, if the molten iron is watched as it is drawn from the furnace, the surface is soon seen to cover itself with dull lumps of scoria and impurity, which rise to the surface. It is usual to fill the moulds more than full, so that the lighter substances may float to the top and collect in the portion to be subsequently cut off; but this does not entirely remove them. M. Van Riet, to give the impurities time to separate from the melted iron before it runs into the mould, sets on top of the flask a sort of little bath tub, lined with some refractory substance, and presenting three cylindrical hollows of different sizes, communicating with each other by tangential channels. The iron is poured from the ladle into the larger hollow, where it whirls around for a time and then escapes into the second basin, where it revolves in the opposite direction. From this it reaches the third compartment, which has a hole in the bottom, and, as this hole is set over the pouring hole in the flask, the iron then runs out into the mould. When the metal is poured into the large end of the tub, it is seen to whirl around until the surface is covered with the larger particles of impurity, which collect near the middle, the centrifugal force developed by the whirling serving to separate the purer and more liquid iron from the light and spongy scoriæ, very much as cream is separated from milk by a centrifugal churn, or molasses from sugar in the centrifugal tanks of a refinery. By the tangential channel the purer iron passes into the second division, where the same process is repeated, the scoriæ, which are now in fine particles, collecting in the middle, while the liquid metal keeps to the outside. The third canal, also tangential, leads this twice purified iron to the third compartment, from which it runs into the mould, a few particles of dross floating up from the mould and collecting at the top. On cooling, the first division of the "bath tub," or "poche intermédiare," as its inventor calls it, is found to contain the large lumps of cinder, while the second compartment contains a spongy mass of impurity, in the shape of an inverted cone, the base of which occupies the whole area of the compartment, the pure metal having escaped around the sides below. In the third compartment nothing appears but a little ring of particles, the last to rise to the surface out of the mould. The castings made from iron thus purified are extremely sound and solid, and there is no loss of metal, all the pure and liquid iron escaping into the mould. The "bath tub" is easily cleared out, and is relined for a second operation by plastering with fire clay mortar.

Pussy Rides in a Flywheel.

"I have got a kitten at home," said W. L. Slocum, of Manchester, N. H., "which I think has traveled about as rapidly and as far in one day as any other animal in the world. One morning, about a month ago, the kitten strayed into my factory a short time before the machinery was started up. It got playing around the floor and soon took up its position in the big flywheel, where, without being noticed, it nestled down and went to sleep. Soon the machinery was put in motion, the wheel moving so rapidly that the poor kitten could not escape. Indeed, it is probable that puss was soon unconscious from dizziness.

"A little computation shows the distance the cat traveled. The wheel moves at the rate of 250 revolutions a minute, and at every turn pussy went 17 feet. As the wheel was kept in motion 390 minutes without stopping, the kitten must have traveled during that time a little over 300 miles. When the wheel was stopped the kitten was discovered and taken out more dead than alive, but it shortly recovered, and, although it has remained about the factory ever since, it is observed that it always gives the flywheel a wide berth."—St. Louis Globe-Democrat.

Pussy Captures an Eagle.

Charles Wiswell, of Carbonate, Lawrence County, S. D., has a cat that is a king of its kind. Besides being a good mouser, this remarkable feline is death to mountain rats, night hawks, and other small game, not long ago bringing home as the result of its prowess a large jack rabbit. But the most remarkable incident in the cat's history happened a day or two ago.

It was an encounter with a full grown bird of freedom, and pussy was the victor. The cat was sitting on a pile of quartz patiently awaiting the reappearance of a chipmunk, which but a moment before it had chased into a hole, when suddenly the sky above the cat became darkened, and an ominous swish as if from a rapidly moving body fell upon pussy's ear. The cat sprang aside with a motion so rapid that the eye could scarcely follow it, and in the place it had occupied but a moment before stood a full grown bald eagle, its plumage ruffed and thirsting for blood. Pussy had sand and accepted the gage of battle, and in less time than it takes to tell it, the famous "cat and parrot" time was being re-enacted. It was a desperate struggle, and although pussy was pretty badly scratched by the eagle's talons, it, when taking the initiative in the fight, secured a decided advantage, having landed on the eagle's back. For a few moments the air was filled with fur and feathers, and the ground was all torn up, but pussy held on, and in a short time succeeded in biting through the neck of its antagonist. The struggles of the eagle grew weaker and weaker, and soon ceased altogether, and pussy, exhausted by the violent exertions and sore from wounds inflicted by the eagle's talons, rested for a moment, then, as calm as though sitting on a rug before the kitchen hearth, went carefully over the ruffled fur, made its toilet, and, seizing the body of the vanquished antagonist, drew it with much difficulty to the home of its master. Laying it at the master's feet, the cat purred its satisfaction, and in this way boasted of the victory.

The combat was witnessed by a number of people, every one of whom expressed a desire to buy the cat, but Mr. Wiswell says he would not sell it for the best mine in the Black Hills. The eagle measured six feet four inches from the tip of one wing to that of the other.—St. Paul Pioneer Press.

He's Dead at Present.

Julius Cæsar was considered a great man, and so he was. But he had his limitations, and some unknown writer gives a few illustrations: He never rode on a 'bus in his life; he never spoke into a telephone; he never sent a telegram; he never entered a railway train; he never read a newspaper; he never viewed his troops through a field glass; he never read an advertisement; he never used patent medicine; he never cornered the wheat market; he never crossed the Atlantic; he never was in a machine shop; he never went to a roller skate rink; he never controlled a manufacturing company; he never dictated a letter to a typewriter girl; he never invested in railway stock; he never played a game of billiards; he never saw an electric light; he never listened to a phonograph; he never posted a letter; he never had his photograph taken.

RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—Oscar E. Morse, Dillon, Montana. This engine has a casing in which are cam races, and within the casing is a rotary cylinder in which the pistons move, links connected to the pistons extending beyond the center of the cylinder, and projections carried by the links having movement in the cam races. The construction is designed to be very simple and economic, having but few wearing parts, and working either forward or backward with equally good results. A dead center is avoided in this engine.

BOILER.—Benjamin F. Conner, Columbia, Pa. This invention provides a boiler consisting of a series of water circulating sections set one on top of the other and forming a passage for the smoke and gases. Surrounding the sections is an exterior shell into which leads the upper end of the smoke passage. The exterior shell is preferably made in sections similar to the water sections. The spaces between the several water sections are readily cleaned of soot or other accumulations, and the heat generated by the fuel is utilized to the greatest advantage to heat the water in the sections.

Railway Appliances.

CAR FENDER.—Elie B. Graff, Baltimore, Md. This device is adapted to be connected to either end of the car, and has cushions, springs, and a receiving bed, designed to prevent injury to persons caught in the way of a moving car. The bed of the fender is preferably of heavy woven wire or similar material, fastened between side bars of spring steel, and made elastic by means of coil springs. Along the front edge is a hollow cushion, preferably of soft rubber, a similar second cushion being also attached to the rear upturned edge, to prevent violent contact of one falling with the car body.

Electrical.

TELEPHONE.—John Serdinko, San Antonio, Texas. In this instrument, combined with the magnets of the magneto call, the bobbin and the diaphragm fixed in front of the latter, an iron disk is fixed in proximity to the magnets, and a core fixed to the disk extends through the bobbin into close proximity to the diaphragm. The improvement is designed to afford a simple and effective magneto telephone in which the receiving and transmitting instrument will receive its magnetism from the magnets of the magneto call.

Mechanical.

DEVICE FOR TRANSMITTING POWER.—James Evans, Linn Grove, Iowa. This inventor has devised a simple and flexible device, particularly adapted for transmitting power from the pump rod of an ordinary windmill to a washing machine, churn, or other light machine. It is arranged to pass around corners and angles to be connected with a machine in any position desired. To the pump rod is attached a rope extending over a guide pulley to an oscillating lever, from whose free end extends a transmitting wire, the latter extending over a guide pulley, etc., to convenient connection with the machine to be operated. A coil spring is arranged to take up the slack on the return stroke of the pump rod.

SAW GUMMER OR SHARPENER.—Jerrold E. Oglesby, Ladonia, Texas. This is an improvement in devices for grinding the saws of a cotton gin or linter, the inventor providing a simple apparatus which may be easily applied to a gang of gin saws, and quickly and nicely adjusted to properly fit the teeth, entering between them to any desired distance. The apparatus also has an efficient feed mechanism which moves the saws tooth by tooth as they are ground, while also regulating the pitch of the grinder, the machine doing the work rapidly and nicely to leave the teeth their full original length and openness.

Agricultural.

CHECK ROW PLANTER.—Edward W. Collins, Coalville, Iowa. With the use of this machine a marking compound is dropped upon the ground to check the rows, simultaneously with the dropping of the seed from the boxes. The machine also smooths or levels the ground to receive the marking compound, and a driving mechanism operated from one of the supporting wheels has simultaneous and timed action upon the drop slides of both the marking and seed boxes.

Miscellaneous.

SMELTING TITANIC IRON ORE.—John L. Randall, Brooklyn, N. Y. This inventor has devised a method of and composition of matter for smelting by which this ore may be profitably smelted in an ordinary furnace, and the operation continuously conducted without injury to the walls of the furnace. Employed with the ore is a flux composed of cast iron fragments, puddling furnace slag, feldspar, all used with any suitable fuel in a blast furnace. With the method described a superior cast iron is produced, and the cost of operating the furnace does not exceed that of smelting the ordinary iron ore.

HAME TUG.—Julius C. Clausen, Hensall, Canada. This tug is hinged to a buckle, and has cross bars provided with notches on their inner sides, cross rods being arranged in front of the bars. The trace and its fastening hook has a tongue and out-turned point adapted to engage the cross bars and rods. To adjust the trace it is only necessary to slacken the tension on it, and when adjusted there is always a straight pull on the tug.

HORSE COLLAR.—William T. Fell, London, England. This is an open-topped collar constructed upon a steel spring as a frame which occupies the position of the fore wale and also serves the purpose of the hames. It is designed to facilitate the operation of harnessing and unharnessing of vicious and timid horses, as the collar does not need to be passed over the animal's head. A snap lock engages the ends of the two members of the collar, and a safety catch engages the bolt of the lock to lock it in closed position.

SHOE.—Thomas F. Marshall, Oakland, Cal. A lining for the elastic gores of boots and shoes, that will be both yielding and watertight, has been devised by this inventor, the lining also presenting a substantially smooth surface to the foot. A watertight lining for the gore is connected by a bellows fold with the edges of the boot or shoe lining, the members of the bellows fold lying normally beneath the lining and meeting at an angle to lie substantially flat on each other.

DRYING RAW OR PREPARED GOODS.—August Rubenkamp, Dortmund, Germany. The apparatus designed by this inventor allows of the gradual warming and cooling of the goods treated. It comprises a series of drying chambers, each having lower channels connected with a source of heat and with conduits from which lead valved outlets. The heated air which dries the goods is afterward brought back to the closed furnace to effect combustion of the fuel.

DOOR HANGER.—William F. Johnston, Buffalo, N. Y. The blocks adapted for attachment to the door, according to this improvement, have inclined faces with longitudinal grooves, while adjustable inclined end bars have loops on their upper ends and projections on their lower ends that work in the grooves. A horizontal top bar, on which wheels are centrally carried, is adjustable at its ends in the loops. The construction is such that the door may be readily hung in thorough balance, and easily adjusted to keep it plumb, no matter how it may warp or settle.

ADVERTISING MACHINE.—William T. Shirley, St. Elmo, Tenn. This inventor has devised improvements in mechanical devices for the continuous display of advertising cards, and particularly adapted to exhibit a series of advertisements on a longitudinally moving sheet of canvas or other flexible material. The improvement comprises a novel, power-driven, compact and simple apparatus, which moves the display sheet in one direction until all the advertisements have been exhibited, then reversing the direction of travel of the sheet to display the same advertisements in reversed order.

WAGON BRAKE.—Vardiman T. Sweeney, Springfield, Ky. This is an improvement on a formerly patented invention of the same inventor, designed to simplify the construction and increase the efficiency of the brake, providing also for conveniently applying the brakes to both the forward and rear wheels of the vehicle, either by backing the team or by means of a lever or its equivalent.

SASH FASTENER.—John H. Dickson, New Philadelphia, Ohio. According to this improvement, the socketed side bar of the sash and socketed casement are rubber lined, and a slide bolt adapted to be longitudinally moved therein. The sliding locking bolt has a projecting pusher bar on which a spring acts, while a hinged pendent locking plate, sliding on its bearing, is adapted to be raised and adjusted and dropped into engagement with either side of the pusher bar. Applied to the upper and lower sashes, it affords means to lock either sash partly open or closed.

SASH LOCK.—Charles A. Robert, Portland, Oregon. This is a lock of simple and inexpensive construction, adapted to be located in the jamb of the window to engage with the sash, the lock being manipulated from the front of the window frame. It is so made that two locks may be employed in connection with each sash, one for the upper and the other for the lower, without having either interfere with the other, and without presenting an unsightly appearance.

TRACE.—George S. Duffin, Cheneyville, Ill. This trace is formed in two sections, united at their adjacent ends by jointed coupling, the shanks of which enter and are riveted in the split ends of the trace sections, the inner side of one section having a rearward extension crossing the coupling to take the wear, and the coupling being in rear of and wholly independent of the back strap connections. The construction prevents twisting of the trace, and gives perfect ease and freedom to the animal at all times.

HAY PRESS.—John F. Adams, Aledo, Ill. With this machine hay, grain and similar material may be raked from the field, delivered into the body of the machine and automatically baled and delivered in compact form upon the ground. The construction is such, also, that the rakes may be detached and the baling apparatus connected with the separator of a thrashing machine, so that the straw which issues from the machine may be gathered and baled.

MICROMETER GAGES.—Herman V. Bernhardt, Brooklyn, N. Y. An automatic stop for gauges and similar tools, designed by this inventor, is so arranged as to prevent the operator from exerting an overpressure and causing a consequent spreading of the contacting ends of the micrometer or other tool. The invention consists of an internally toothed head or cap adapted to be engaged by a spring-pressed pawl or pawls mounted to slide laterally on and turning with the micrometer spindle.

INK STAND.—Francis B. Pratt, Canton, Miss. In a base piece circularly recessed at two points in its top, one recess has a funnel-shaped bottom, and a passage extends therefrom to the bottom of the other recess, in which is an interiorly threaded shell, in which screws a hollow plug, there being a set screw adjustable in the top of the plug. The ink stand may be readily filled and kept clean, and the supply of ink in the ink well graduated exactly as needed.

PAINT.—Carl L. C., Max W. H., and August M. H. De Bruycker, Brooklyn, N. Y. This is a new enamel paint designed to leave a good body, so that one coat of it will equal two coats of ordinary paint. It is made of Venice turpentine, linseed oil and litharge, mixed and boiled, to which are added turpentine, benzine, white lead, zinc white and plaster, the whole being ground together.

VALVE FOR OIL CANS.—Charles Wagner, New York City. This is a valve attachment for the spout of a jet oil can which affords a reliable and convenient means for regulating the discharge of any desired quantity of oil from the can, prevents leakage and seals the receptacle against accidental discharge of its con-

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tents. The can may be conveniently filled, and the device is of simple construction and not liable to get out of order.

VENDING MACHINE.—James Walton, Phoenicia, N. Y. This is a machine for vending either stamps or paper and envelopes, but it is preferably arranged with duplicate parts, so that both may be delivered by one machine. It is designed to be simple and inexpensive, and with easily working mechanism, which is not liable to get out of order, the delivery of the postage stamps and paper and envelopes being effected by mechanism controlled by dropping a coin in the slot of the machine.

STREET SWEEPER.—August G. Rosenhauer and Richard Brussel, New York City. This sweeper is designed to afford means of sweeping the entire breadth of the roadway, elevating the sweepings as the machine moves along and depositing them in a dirt receptacle, which can be conveniently dumped at any desired point. The movements of the brushes are controlled from the driver's seat in such manner that the brushes may have a light contact with the roadway, or may be made to bear heavily thereon, or lifted entirely clear and their motion stopped.

Designs.

DESIGN FOR TRIMMING.—Josephine Muller, New York City. The principal feature of the invention consists of serpentine opposing side lines, forming a series of curved loops appearing independently formed, one merging into the other, imparting to the trimming a plaited appearance. In the details of the design a central ornament is formed between the marginal lines, having an embossed appearance, and cross ties appear to separate the series of loops.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

SCIENTIFIC AMERICAN BUILDING EDITION.

NOVEMBER, 1894.—(No. 109.)

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2. Plate in colors showing the residence of John Cottier, Esq., at Bensonhurst, L. I. Three perspective elevations and floor plans. Cost $6,750 complete. A good example of Colonial architecture. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
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9. A stable and conservatory attached to the residence of John Cottier, Esq., at Bensonhurst, L. I. Perspective elevation and ground plan. Messrs. Parfitt Bros., architects, Brooklyn, N. Y.
10. A residence at Ardmore, Pa., in the Queen Anne style. Perspective elevation and floor plans. Cost complete $6,750. Architects and builders, Messrs. J. B. Cornell & Sons, Philadelphia, Pa.
11. A cottage at Edgewater, Ill., erected for Edgar Smith, Esq. A unique design in the Colonial style. Cost $7,800 complete. Two perspective elevations and floor plans. Mr. G. W. Maher, architect, Chicago, Ill.
12. An attractive cottage at Bath Beach, Long Island, N. Y., recently erected for G. W. Snook, Esq. Two perspective elevations and floor plans. Mr. Percey Emmett, architect, Bath Beach, Long Island.
13. Miscellaneous contents.—Wood pavement in London.—Preservation of wood.—Methods of constructing chimney flues and pipes at Paris, illustrated.—The passing of red brick.—Long distance house moving.—Carved and fancy mouldings, illustrated.—A new sash lock.—Automatic heat regulation in houses, etc., illustrated.—Woodwork vs. flame.—Curiosities about wood.—Cement water tanks.—An improved hot water heater. illustrated.—How to cool a cellar.—A new woodworking machine, illustrated.—An improved stage bracket iron, illustrated.—Party walls.—Architectural metal ornaments, illustrated.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(6305) J. J. H. asks: 1. How high above the level of its source will an ordinary hydraulic ram raise water? A. The ordinary water rams will force water to 100 feet, and in small quantity under favorable conditions to 200 feet, if the distance is not excessive. See the possibilities and computed conditions for hydraulic rams in SCIENTIFIC AMERICAN SUPPLEMENT, No. 793, 10 cents mailed. 2. Will a sheet of zinc burned in a stove loosen soot in a chimney? A. The burning of zinc is said to loosen soot in the chimney. We apprehend the cause to be in the deposit of zinc oxide on the surface, which prevents the soot from sticking. The burning of zinc should be done after a chimney has been cleaned. 3. Does the temperature of steam increase with the pressure? A. The temperature of steam increases with the pressure. 4. What is taggers iron? A. The brand of iron from which tin plate is rolled.

(6306) H. E. J. B. asks: 1. How is white or cream sealing wax made and what can I use in place of bleached shellac for making bronze or gold sealing wax? How is the wax poured in small strips about ¼ inch in diameter? A. A beautiful variety (aventurin), which can be prepared at comparatively low cost, is obtained by stirring finely powdered mica into the melted ground mass. Gold and silver waxes are obtained by mixing finely powdered leaf metal with the melted ground mass. Ground mass for translucent wax is:

Bleached shellac	3 parts.
Viscid turpentine	3 "
Mastic	6 "
Chalk	2 "

For white sealing wax add zinc white. Bleached shellac must be used. For information in regard to moulding sealing wax we refer you to Brannt's "Varnishes, Lacquers, Printing Inks and Sealing Waxes," $2.50. 2. How can I make gold plating to rub on, also silver plating to rub on places that is buffed off too much? A. Gilding.—Articles of steel, copper, silver, and some other of the baser metals may be gilded by simply immersing them in a weak solution of the chloride of gold. Silvering.—Dissolve 1 ounce crystals of silver nitrate in 12 ounces soft water, then dissolve in the water 2 ounces potassium cyanide. Shake the whole together and let it stand until it becomes clear. Have ready some half ounce vials and fill them half full of Paris white or fine whiting and then fill up the bottles with the liquid and it is ready for use. The silver coating is not as tenacious to the article as when electrolytically deposited. This is very poisonous and should be handled with great caution—if at all. 3. In making gold chloride from coin after dissolving in nitro-muriatic acid and precipitate with ammonia, will any copper be thrown down with the gold if there had been any in the gold coin or will it remain in the acid? A. Precipitate the copper first by adding sodium bicarbonate until effervescence ceases. The copper will be deposited as a green carbonate of copper. Filter, and add enough nitric acid to turn blue litmus paper red. 4. I have "Experimental Science" and would like to know if I made a dynamo one-quarter size of the hand power dynamo on page 488, would I get a sufficient power to ring an ordinary 2½ inch bell, such as is used with a battery? A. Yes. 5. What will dissolve bichromate of potash and gelatin off glass that has been exposed to sunlight? A. Try weak hydrofluoric acid. 6. How can I put the finishing polish on an opal? A. Use fine emery applied to a lead lap, finish with rottenstone and water. 7. How can iron or steel be blued without heat? A. Solution of potassium ferricyanide and water, one part of the potassium salt in two hundred of water; solution of ferric chloride same proportion. Mix the two solutions and dip.

(6307) M. W. asks: Why is it that dirt taken from an excavation will not fill it when replaced? A. The dirt and sand of all original soils, except wind-driven sand, is solidly packed, having been deposited slowly in water in the early geological ages, by which action the particles were floated into contact, thus occupying the smallest possible volume. When such earth is disturbed the contact is broken, a thin film of air separates the particles and keeps them from falling into the closest relation. This is proved by pouring and ramming dry sand into a keg and then pouring in water to saturation; then by shaking the keg the sand will settle into close contact, showing the difference in volume.

(6308) J. E. H. asks: 1. What is the best kind of glass to be used in making Wimshurst machine? A. Thin crystal plate. 2. What size wire shall I use to wind sewing machine motor for 110 volts? A. For motor described in SUPPLEMENT, No. 641, use No. 3 wire on field and No. 28 on armature. Start it with a resistance in series or you will burn out the armature. 3. A good method to cut the tops off two quart bottles. I would like to make battery jars out of them. A. Notch the glass with a file; rub it back and forth with a red hot pipe stem or poker. When a crack starts, lead it around with the hot poker or pipe stem. It is well to tie a string around the bottle as a guide. Rub off the sharp edges with a whetstone such as used for scythes.

(6309) N. B. P. asks for browning for shotgun barrels. Also how is the best way to remove what is left of the old browning? A. Wet a piece of rag with chloride of antimony, dip it into olive oil, and rub the barrel over. In 48 hours it will be covered with a fine coat of rust Then rub the barrel with a fine steel scratch brush, and wipe with a rag dipped in boiled linseed oil. Remove the old coating with oil and emery paper, then remove the grease with caustic potash and treat as above.

(6310) O. S. asks for the relation of the armature wire resistance to the field winding of a series and a shunt dynamo. A. In a series dynamo the resistance of the field magnets should be two-thirds that of the armature; in a shunt-wound dynamo the product of armature and field resistance should be equal to the square of the external resistance. The armature resistance is equal to one-quarter the resistance of the length of wire used in winding it, unless of course the wire is used in parallel.

(6311) W. D. asks: If a bar of wrought iron 1 inch in diameter and 1 foot long, carrying a coil of insulated wire and moving at a speed of 20 feet per second past a permanent magnet distant 1 foot, this magnet having a cross section of 3 inches and a space between its poles of 1 foot, is it possible by varying the quantity of wire to induce a current having a value of 1 watt? A. A current is not measured in watts, but in amperes. It would be very difficult to produce a one ampere current with one volt potential difference in the circuit under the conditions named.

(6312) H. C. W. asks how many storage cells it would take to run the motor 641 to the best advantage, and can the motor be used as a dynamo to charge the batteries? A. Four cells of storage battery will run the motor. It is not adapted for use as a dynamo.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

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November 20, 1894,

AND EACH BEARING THAT DATE.

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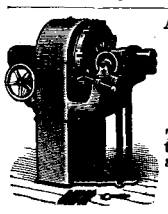
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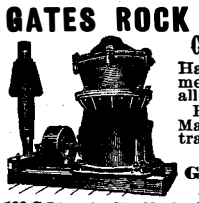
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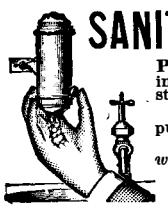
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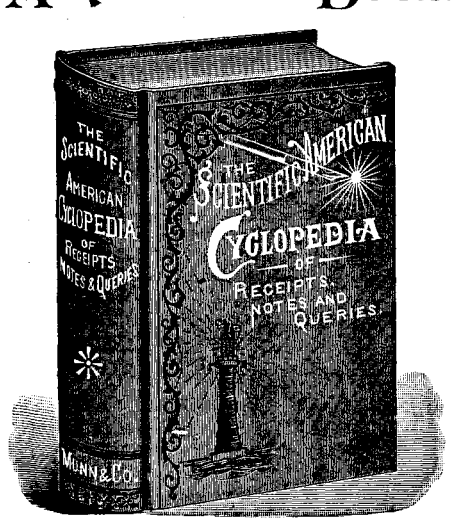

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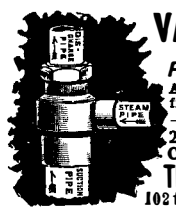

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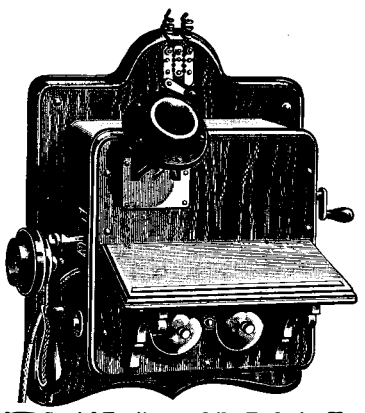

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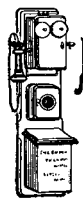

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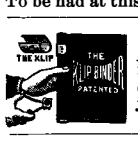

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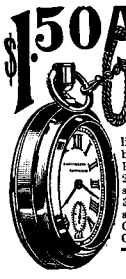

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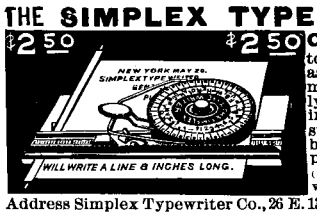

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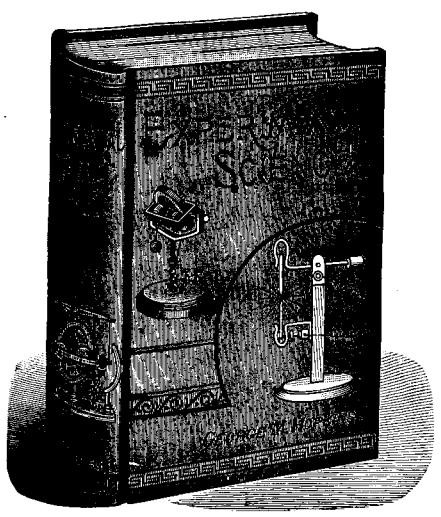

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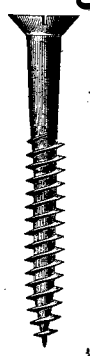

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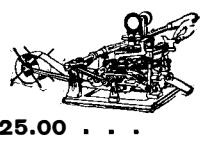

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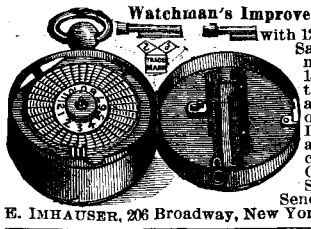

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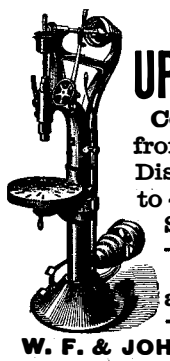

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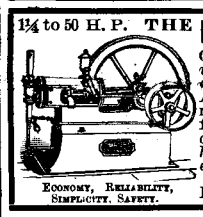

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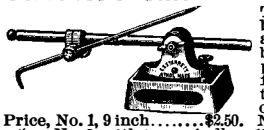

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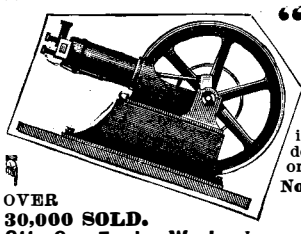

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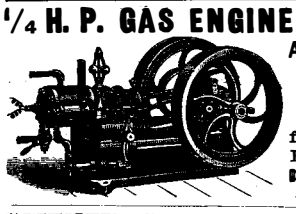

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